Students' Perspectives on Artificial Intelligence in Education

Thesis

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Statement of authenticity

By submitting this work, I declare that this work is entirely my own except those parts duly identified and referenced in my submission. It complies with any specified word limits and the requirements and regulations detailed in the course work instructions and any other relevant programme module declaration. In submitting this work I acknowledge that I have read and understood the regulations and code regarding academic misconduct, including that relating to plagiarism, as specified in the programme handbook. I also acknowledge that this work will be subject to a variety of checks for academic integrity.

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Abstract

This research aims to identify the perspectives of students on Artificial Intelligence (AI) in education. This research looks at the positive and negative impact of AI tracking systems and AI technologies. The expectations of AI in Education (AIED) are studied in this research. The data gathered from the online survey are analysed and divided into variables. Task-Technology Fit model is used to understand the relationship between the independent and dependent variables. These variables are used to define the outcome and results. By using the findings from the literature and analysis, the outcomes provide the results for hypotheses and research questions. The results reveal that the independent variables, age groups and gender, have an impact on individual performance and the actual tool use of AI technology. In the findings of this research, females and males would welcome the idea of implementing AI in education. However, females have security concerns regarding AI tracking systems (Sanders, 2008) as they are less likely to receive technological education compared to males (Huffman, Whetten, and Huffman (2013). Females would like to use AI technologies to improve their performance as Chatbots, Recommendation Modules, and tracking systems can offer new ways of studying (see Chapter 3). On the other hand, males would like to use AI technologies as they receive more technological education compared to females that lead to females having anxiety towards using technology such as AI tracking systems, and personalised online environments (Sanders, 2008). The findings also point out that older females would like to use AI technologies more than younger females and their counterparts. However, both females and males believe that AI would bring a better learning experience for students.

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1. Introduction

Artificial Intelligence (AI) has developed significantly over the years. In the last 25 years, AI in Education (AIED) has become a critical focus of researchers (Roll & Wylie, 2016) as AI can offer new technologies that can be useful for students (see Section 3.3) and AIED can provide students with better learning experience and environments. Liu (2018) expressed that AI is a creative and challenging area. Liu also mentioned that AI and education could create an environment where teaching and learning can be improved by using the efficiency and effectiveness of AIED. Han (2018) said that AI is a trend that contains the development of education (p. 609). The rapid development of AI means that AI is creeping into education, and they both complement each other as both can be benefited from helping each other (Han, 2018). The use of AIED is inevitable. The rate of development of AI is escalating quickly, and there are already many applications that are implemented and tested. As students are the ones using AIED, their perspectives are important. For that reason, the researcher aims to identify their opinions on AIED by providing some of the AI technologies that are used in education.

The literature related to AIED are gathered and reviewed. A research model of the Task-Technology Fit model (Dishaw M.T., 1999) is used to identify the effect of AI technologies on the individual performance and actual tool use based on the gender and age of participants as this is survey research.

The survey consisted of thirteen questions was sent out to the family members and friends of the researcher. The duration of the activation of the survey was four weeks. The data retrieved from the participants were turned into manageable data set using an Excel application. The data were analysed and discussed using tables and figures. The findings from the literature review and the analysed data provided the relationship between the independent and dependent variables that supported the outcomes and results for the hypotheses and research questions.

This thesis is divided into chapters as follows:

- Chapter 2 introduces the research problem, objectives, questions, hypotheses, and the significance of this research
- Chapter 3 includes the literature review related to AIED along with the literature selection, databases used, and literature findings in a table in which the literature provides the previous research conducted on the topics of AIED and the findings of the literature

- Chapter 4 explains the research method, the sampling size, the conceptual framework, research design, hypotheses, and the relationship between hypotheses and research questions
- Chapter 5 provides the analysis of the data, the tools used to analyse the data, the detailed analysis of independent and dependent variables, and the P-value to find out the significance between the variables
- Chapter 6 discusses the relationship between the findings of the literature review and analysis and compares them with the hypotheses using the findings from Chapter 5, and
- Chapter 7 concludes the thesis.

2. Research Questions and Hypotheses

An overview of the chapter

This chapter consists of the introduction to the research problems, the description of the research problems, the objectives of this research, the main research questions, and the hypotheses. A table describing the correlation between the hypotheses and the research questions is also presented.

2.1 Introduction

The origin of Artificial Intelligence (AI) can be traced back to the mid-to-late 1900s (Becker, 2019). However, in recent years, the interest in AI from business, media, and political organisations has elevated the area of research regarding AI software and applications (Pan, 2016). Since 2014, there was a significant development in AIED regarding learning in groups and implementing AI technology into the educational environment (Roll & Wylie, 2016). As described by Timms (2016), a technology designed to use in the classroom has been delivered mostly via computer (p. 701). He also argued that computers used in education were intended for office use. Artificial Intelligence in Education (AIED) systems developed to this day were mainly based on creating an environment to get students to be familiar with devices or applications that they will use once they go into workplaces. Also, teachers do not have their say over the technology as the technology is the main component rather than students and teachers (Timms, 2016).

As technology is the main focus, there is a need to research the viewpoints of students on AIED. This chapter begins with the research problem and the objectives of this research. The research questions and hypotheses are identified in this chapter, and also the relationship between the research questions and hypotheses are also shown in a figure format.

2.2 Research problem

The advancement of digital technologies has changed the way students study (Chassignol, Khoroshavin, Klimova, & Bilyatdinova, 2018). Artificial Intelligence (AI) is a part of the advancement, and it is becoming a part of education. As described by Chassignol, Khoroshavin, Klimova, and Bilyatdinova (2018), education sector is affected by the development of AI. Even though AI has taken a new approach in which AI would help humans to perform better in many areas such as business, production, and everyday life for many people, it is important to find out the impact of AI on the education (Chassignol, Khoroshavin, Klimova, & Bilyatdinova, 2018, p. 17). Moreover, there are also security concerns and ethical considerations regarding AI as well (Mantelero, 2018). AI also needs a lot of information to perform a particular task (Núñez Reiz, Armengol de la Hoz, & Sánchez García, 2019). As big data and data management are being researched more, and many researchers suggested that there should be some form of data governance to take control of the situation if anything goes wrong (Núñez Reiz, Armengol de la Hoz, & Sánchez García, 2019).

The research aims to study a gap between AIED and students. The survey research had been conducted to understand students' points of view on AI.

Understanding what students want from AI may help bridge the gap and ensure that AI has positive effects on education in terms of security and safety for students.

2.3 Research objectives

The research objectives indicate the goals of the research (Creswell, 2014). The primary purpose of this research is to investigate the relationship between AIED and the perspective of students. The advancement in AI technology has reached into education (Dickson, 2017). However, there is no guarantee that AI will perform as expected as it is a relatively new technology. The main objectives of this research are to find out the usefulness and the expectations of AIED as well as the expectations that students have on AI in terms of gender and age groups of participants as mentioned in Chapter 5. In addition to that, the other objective is to look at the security and privacy of students to make sure that AI can provide a safe learning environment for students and students' wiliness to use AIED.

There are many research projects and studies in the area of AI. However, the studies around the effects of AI on education have not been considered in depth to the researcher's knowledge. This research does not measure the performance of students in anyway as this is a convenience survey research (see section 4.9). The participants in this research are made up of students, teachers, participants who studied within five years and those who studied over five years ago.

2.4 Significance of the research

Conducting this research may help understand the factors that impact on students' views on AI, safety surrounding AIED, and the effect of personalised Learning Management Systems (LMSs). Students' views play a critical part in education. For example, the AI technology like Artimat (Artificial Intelligence Based Distance Education System) can solve mathematical problems with ease (Karal, Nabiyev, Erümit, Arslan, & Çebi, 2014). However, one of the issues raised by students is that technology cannot provide elaborate answers as it can only show the final results. Getting feedback and listening to students may result in creating a better version of technologies.

This research may also help understand what students want from AI, how AI could be used in positive ways as intended, how the quality content and personalised learning environments could provide a better learning experience for students, and how AI can ensure the safety of students.

2.5 Research questions

The main research question for this thesis is:

RQ. 1 "What are the impacts of using artificially intelligent tracking systems in education?".

There are two sub-questions under the main research question:

RQ. 1.1 "What are the advantages of using AI in education?" and

RQ. 1.2 "What are the disadvantages of using AI in education?".

The first sub-question is to find out the positives of possible new technologies that can be used in education. The second sub-question is to look at possible issues around AIED as mentioned in Chapter 3.

2.6 Hypotheses

There are six hypotheses. These hypotheses are predictions or expected outcomes of investigating the effect of AIED.

The hypotheses used in this thesis are called directional hypotheses, in which the literature can predict the expected outcome (Creswell, 2014). There are six hypotheses that are the expected outcomes of this survey research.

Hypothesis 1: Students who use AI will have better performance.

Hypothesis 2: Students who do not use AI will have better performance.

Hypothesis 3: Students will not feel safe using AI online tracking systems.

Hypothesis 4: AI is a useful tool for students.

Hypothesis 5: AI is a tool that students do not need for their study.

Hypothesis 6: AI will be a distraction for students.

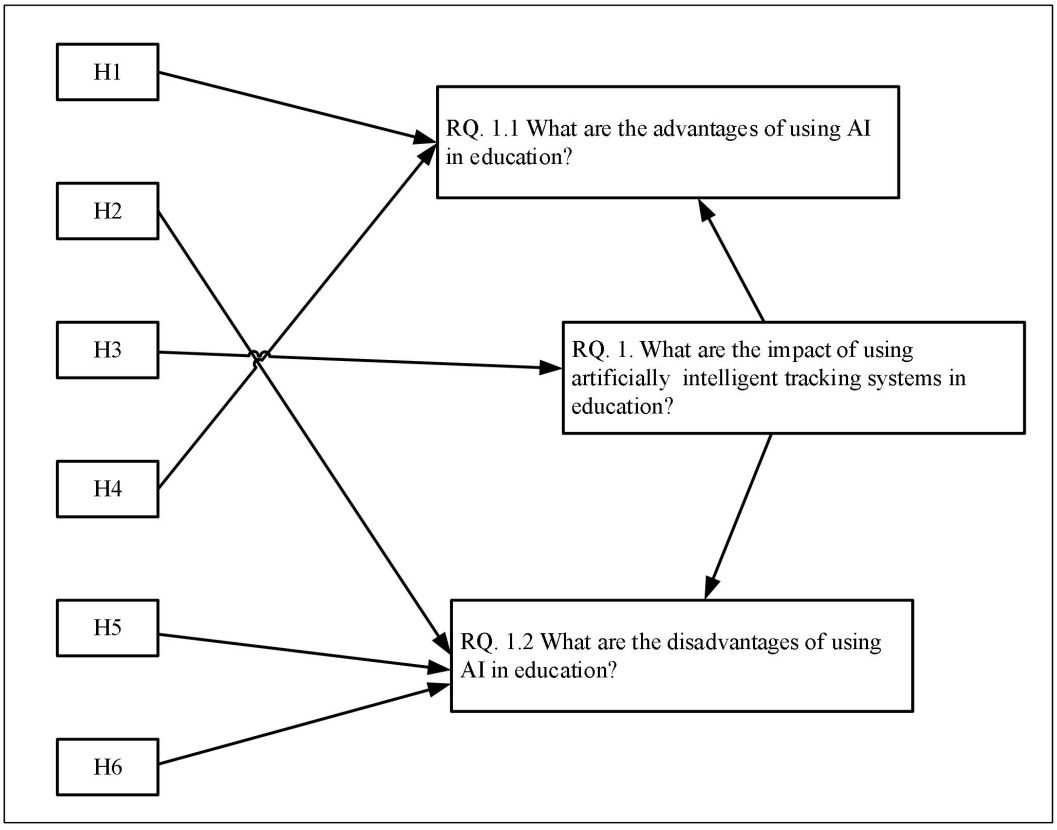

Figure 1. The relationship between RQs and Hypotheses

Figure 1 shows the relationship between the research questions and the six hypotheses. As shown in Figure 1, H1 and H4 are to answer the RQ. 1.1. H3 is to answer the RQ. 1, the main question. H2, H5, and H6 are to answer the RQ. 1.2.

2.7 Conclusion

There are many studies about AIED regarding the development of applications and software. However, research around students' and teachers' roles, and their opinions related to AIED have not been done extensively. This research aims to identify the factors that explores the use of technologies geared towards using AI and computer-based education with little human interaction.

In this chapter, a description of the research problem, research significance, and research objectives, along with the research questions and hypotheses, were provided.

The next chapter looks at the comprehensive literature review of AIED and human factors. The AI technologies being developed to use in education and type of learning styles are also discussed as well as the selection of literature and databases used to collect the literature are included.

3. Literature review

An overview of the chapter

This chapter explores the literature related to this research, analyses the literature, and presents the literature in the form of themes. There are two main parts to this chapter, the AI technologies and the expectations of AI from the perspectives of students. The literature selection, the search process of literature, and the inclusion and exclusion of criteria are presented. Moreover, this chapter discusses the details of the introduction to the literature review, the AI technologies and applications, and the expectations of AIED. In the AI technologies section, the Performance Tracking Systems, Personalised Recommendations using AI, Recommendation Module, Individual Tracking and Progress Tracking, Chatbots, and customisation are discussed. In the expectations of the AIED section, speech recognition, identification of learning styles, cultural effects in learning, security and AI, ethical considerations, and data governance are looked into in detail.

The two literature themes are also presented in this chapter (see Figure 2 and Figure 3). Furthermore, the literature findings are shown in a table format with the authors' names and the year of publication (see Table 1).

3.1 Literature selection

Peer-reviewed literature is used in this literature review, as these articles had been reviewed and refined by experts before publication. The literature provides a robust platform for research to be conducted and also allows a scope expansion of the related (Okoli & Schabram, 2010). The following literature review is a systematic literature review with a defined scope. The systematic literature has the following features, identification of area to be researched, evaluation of results and data, and synthesising the research with existing work produced by researchers and scholars (Okoli & Schabram, 2010). The scope of this research includes the effect of AIED, the use of online tracking systems, AI technologies, safety around AIED, and ethical consideration of AI.

3.1.1 Search process

The search process was a manual search of peer-reviewed articles and conference proceedings. The time frame of the articles was limited from 2013 to 2019 with some exceptions. The literature used in this research were related to AI, learning styles, and educational concerns regarding cultural and ethical issues.

Finding articles was carried out using online databases. There were many databases with different categories. Most of the articles used in this thesis could be found on:

1. ACM (Association for Computing Machinery)
2. Science Direct
3. Google Scholar.

The supervisors also provided articles on how to write a systematically rigorous thesis and other articles requested by the researcher.

3.1.2 Inclusion and exclusion criteria

The peer-reviewed articles related to the scope, as stated above in section 3.1, were included. When selecting literature, the systematic literature was considered first with some exception. Literature with a related area of interest was the first choice as this literature tends to provide vital information for this research.

The articles with informal literature, undefined surveys, an undefined scope, and the different areas of study were excluded.

3.2 Introduction

Education has been an essential part of people's lives for such a long time. Universities and institutions have been trying to provide the best Online Learning Environment (OLE) for students (Popenici & Kerr, 2017). With the development of AI, many education providers believe that AI could be an answer to providing the best OLEs for students. As AI can offer new technologies that were not possible years ago such as personalisation (Wan & Niu, 2018), performance tracking (İçöz, Sanalan, Çakar, Benli Özdemir, & Kaya, 2015), and e-learning environment (Nikolić et al., 2018), students would be able to use these applications for their benefits. As creating such learning environments requires to have many applications, these applications should be working together to provide the best experience of AIED. Tracking the progress of students, personalisation for students, and e-learning platforms are the main essential components to create a personalised environment (Kurilovas, Zilinskiene, & Dagiene, 2014). With the help of these applications, education providers will be able to provide students with the best platform to study and learn.

On the other hand, however, students have been given and using online Learning Management Systems (LMS) that do not provide a flexible platform for students. LMSs aim to provide a platform for teachers where they can create and manage the content of the courses. As for students, LMS has many limitations. One of which is that LMS could not support individuals as it would not be possible to cater to everyone as of right now (Graf & Kinshuk, 2009). However, providing a diverse platform to learn and study for students would create a better learning experience and environment (Blank, Roy, Sahasrabudhe, Pottenger, & Kessler, 2003). With the advancement of AI and LMSs, personalised learning recommendation has become one of the most researched areas in education. DorÇA, AraÚJo, de Carvalho, Resende, and Cattelan (2016) suggests that student learning styles should be considered as an essential part of course creation as it would provide a better learning experience for students (p. 45). Soares et al. (2014) also stated that students should be the focal point of any technology to be used in education (p. 81). When considering students' learning styles, cultural diversity and behaviour should also be taken into consideration as factors in education as "We all learn differently" (Alaoutinen, 2010, p. 1). As students around the world traveling to study overseas, cultural differences play a massive part in the learning styles of students (Alaoutinen & Smolander, 2010, p. 1). Different learning styles affect students' performances as there are many courses in a curriculum (Chamillard & Sward, 2005, p. 241).

To get the best use out of LMSs and online learning platforms, Jaimes and Sebe (2007) suggest using Adaptability. Adaptability allows students to have multiple options and choices that they can accept or reject for their needs (p. 124). By providing these opportunities to students, the system can update their preferences over time to create a suitable OLE (Jaimes & Sebe, 2007). To be able to give choices and recommendations for students, Recommender Systems should be in place to suggest the new materials and content for students (Spano & Boratto, 2019). Spano and Boratto (2019) indicated that this would provide students with consistent processing of systems. On the other hand, Spano and Boratto (2019) also argue that having a tracking system that tracks user's actions and gathers a considerable amount of data could cause distrust from students (p. 1).

For students, a visually pleasing and efficient OLE is a must. Humans should be a critical part of visual analysis (González-Torres, García-Peñalvo, & Therón, 2013, p. 486). González-Torres, García-Peñalvo, and Therón (2013) stated that "Human-Computer Interaction (HCI) is a key component for supporting knowledge discovery" (p. 486). Posard and Gordon Rinderknecht (2015) found that humans liked to work with computers more than with their partners (p. 237). Posard and Gordon Rinderknecht (2015) also discovered that even though humans liked to work with computers, there was no different behaviour pattern towards humans or computers, meaning that humans would not treat computers differently (p. 237).

What if computers become a teammate rather than being a tool that humans can use? (Seeber et al., 2019, p. 1). Seeber et al., (2019) pointed out that if AI were to follow a human command, it would just be a tool that humans use. Instead, Seeber et al., (2019) proposed the idea of using AI as a teammate working together in tandem to create a better version of both humans and machines (p. 1).

There are two main parts to this literature review, AI technologies and the expectations of AI from humans. In AI technologies, the use of AI and how it can be implemented into the existing LMS will be discussed. The other part is the expectations of AI. In this section, what is expected of AI and how implementing AI would improve the quality of study materials will be discussed. Figure 2 and Figure 3 illustrate the flow for this literature review with the themes.

3.3 AI technologies

As stated above, this section includes AI technologies that are being developed and tested. These following technologies aim to improve education in terms of studying and learning for students. As for teachers, they can get help from AI being an assistant in teaching and being an examiner by giving feedback to students in a short amount of time by using these technologies. Figure 2 provides the themes of AI technologies.

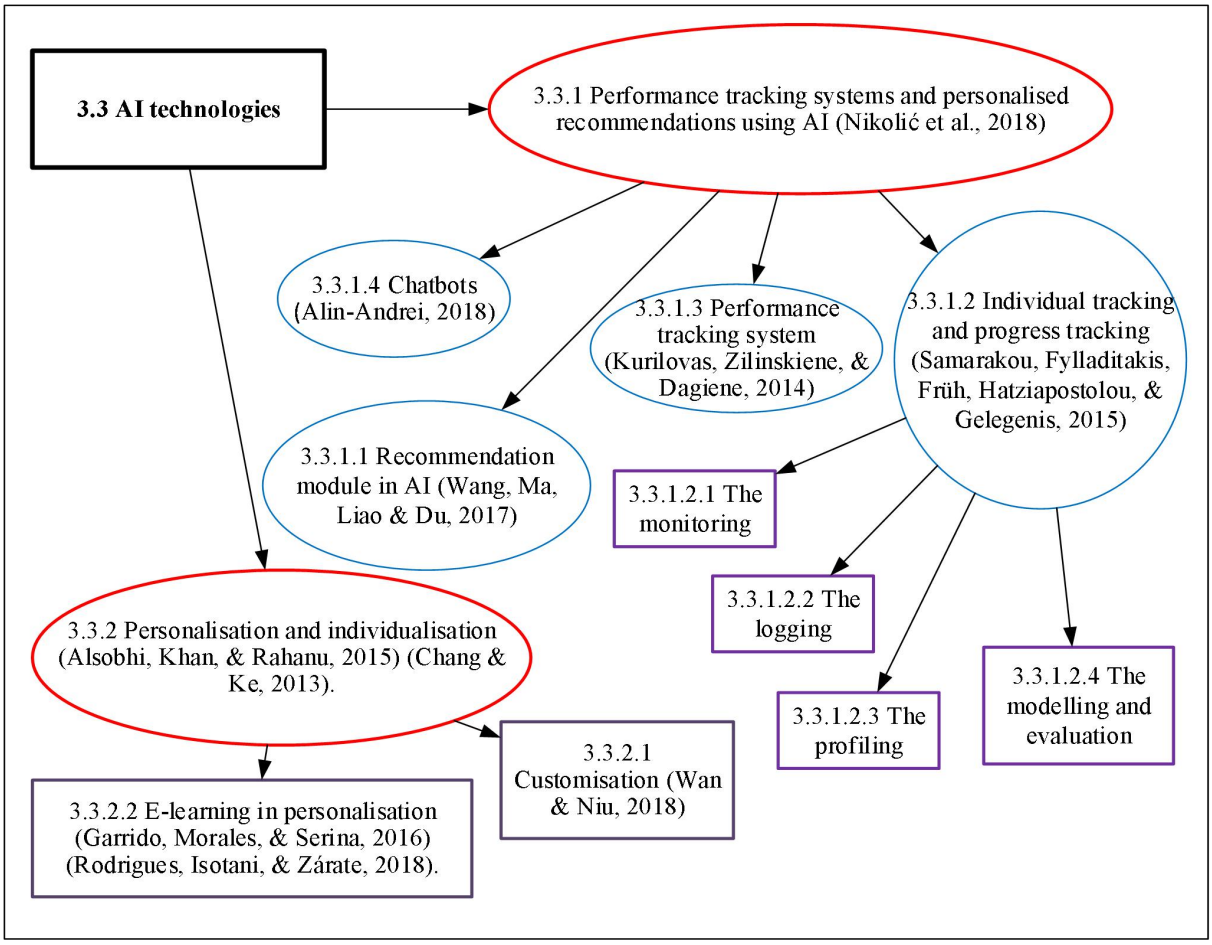

Figure 2. The literature themes of AI technologies

3.3.1 Performance tracking systems and personalised recommendations using AI

When looking at AI applications in education, some universities have been using AI already. Deakin University in Australia has been using IBM's AI for advising students throughout 2017 (Popenici & Kerr, 2017). When it comes to advising students, AI should have individualised online teaching approaches. A platform should be in place to individualise an OLE for students. Platforms such as e-learning and online applications should be available for students to use (see Figure 2). E-learning is the most effective way to teach and learn without face-to-face interaction with teachers (Nikolić et al., 2018). Two factors are deciding the quality of e-learning, the quality of software, and content. The quality of e-learning is solely relying on the control of teachers (Nikolić et al., 2018). Teachers can decide what content is useful for students to study. However, AI can assist in giving suggestions and recommendations to teachers and students, and AI can also provide feedback to students instantly in the form of AI tutors. Students can get feedback on what they should have done without having to wait for a teacher's feedback. However, this does not mean that the development of AI will replace teachers. There are many instances that AI cannot perform yet, such as creating content and providing guidelines for students what materials to study (Verma, 2018).

3.3.1.1 Recommendation module in AI

One of the things AI cannot do is recommending content to students without knowing what they want. To suggest a recommendation to a user by AI, the AI should be given information first before making suggestions. Based on the information gathered, whether by asking what students want or by tracking what materials students like to study, AI would look for content that is useful for students. AI will then provide the content to students through the Recommendation Module (RM), also known as Recommendation System (Q. Wang, Ma, Liao, & Du, 2017, p. 46), which is a system that guides students by evaluating their progress and suggesting resources and materials. Based on their progress, students would be given personalised suggestions by creating a personalised learning environment or a list of suggestions to be considered. Performance tracking systems should be in place to keep track of student's progress and their preferences (İçöz et al., 2015) (see Figure 2).

3.3.1.2 Individual tracking and progress tracking

Tracking student's performance using AI is to keep track of what students are doing on their study time. One way to track is by using Learner Diagnosis, Assistance, Evaluation System based on Artificial Intelligence (StuDiAsE), an advanced OLE (Online Learning Environment) developed specifically to cater to the needs of engineering students. StuDiAse system has five subsystems, the monitoring, the logging, the profiling, the modelling, and the evaluation. Each step has its functions. The system can keep track of individuals, give feedback and profile based on their progress, which means that the system will assess the actions of students and provide the information regarding what type of students they are. For example, some of them would prefer to learn by reading, and some prefer to learn by watching short videos (Samarakou, Fylladitakis, Früh, Hatziapostolou, & Gelegenis, 2015, p. 22). The type of students is discussed in section 3.4.2. The five subsystems will be discussed in the following sections.

3.3.1.2.1 The monitoring

The First subsystem is called monitoring. The monitoring is a part of the system that monitors students' activity during their tests and logs actions of students to understand their preferences regarding educational content. All of the monitoring and logging are performed by the user's consent to provide confidentiality and security for students (Samarakou et al., 2015, p. 23).

3.3.1.2.2 The logging

The second subsystem is called logging. The logging is a part of the system that collaborates with the monitoring system. The main task of logging is to record the actions of students. The output of this subsystem can differentiate each student and their actions (Samarakou et al., 2015, p. 24).

3.3.1.2.3 The profiling

Profiling is the third subsystem that is a part of the system. The main focus of the profiling subsystem is to find out what students have learned in the past and their prior knowledge relating to the topics of the tests. This valuable information will be useful for personalising the OLE. With the use of the data extracted from the logging subsystem, the profiling subsystem will provide the diversity of students' knowledge and the abilities of students (Samarakou et al., 2015, p. 25).

3.3.1.2.4 The modelling and evaluation

The modelling and evaluation are the fourth and fifth subsystems that are a part of the five subsystems. In this subsystem, the data gathered from the profiling is used to give a user with personalised activities and feedback, which students can apply to their study (Samarakou et al., 2015, p. 26).

3.3.1.3 Performance tracking systems

Students are different from one another. Some learn more from watching visual presentations or videos. Some learn more from reading materials. Many factors should be taking into consideration when it comes to providing resources and activities to students (Kurilovas et al., 2014). Different needs and learning styles of students should be the main factor to consider when providing materials. Personalised e-learning environment should be available to provide materials to individual students. Personalised e-learning is not something that can be implemented easily due to the nature of its complexity. However, personalisation can be done by tracking of pages visited, products, and articles read by students. By connecting those web-based pages and the results of the webpages, AI can create a personalised environment (Kurilovas et al., 2014).

As stated above, Learner Diagnosis, Assistance, Evaluation System based on Artificial Intelligence (StuDiAsE) has five subsystems. These five subsystems will perform together to create a personalised OLE. (Samarakou et al., 2015). There are many applications and software to help the personalisation process more accurate to create better data gathering platforms (Kurilovas et al., 2014). If students are performing well in some areas of their study while not doing so well in some other areas, the performance tracking systems will detect the weaker areas and provide necessary measures to students (i.e., suggesting alternative methods of studying or learning) (Samarakou et al., 2015, p. 22).

3.3.1.4 Chatbots

Another form of obtaining accurate data is using Chatbots. Chatbots can keep a record of questions asked by students. If students want to know something, they can ask what they want to know to Chatbots, which means that Chatbots can remember their questions and determine what they like and what they are continually asking (Alin-Andrei, 2018). One of the problems with Chatbots is that they tend to have a lack of communication skills and give boring answers (Yan et al., 2018, p. 149). Yan et al., (2018) suggested that Chatbots should have an evaluation of answer selections and data preparation before answering (p. 154). Domain adaptation is necessary to provide accurate answers by Chatbots, meaning that data should be labelled and categorised before giving answers to students. However, "building a large number of labelled data is expensive" (X. Wang & Yuan, 2016, p. 307).

3.3.2 Personalisation and Individualisation

Personalisation in education using AI is a system that allows students to create their learning environments, whether the environments are in the form of a website or an application. Personalisation could eliminate many barriers in learning and teaching. Some students have difficulties learning through words and sounds. For those people, different materials should be available. People with dyslexia are more likely to learn more from feelings and mental images (Alsobhi, Khan, & Rahanu, 2015). Students have different attributes that are unique to everyone. Some students may not be able to understand some subjects or modules compared to other students. However, this does not mean that they are not capable of learning. Based on these attributes, learning theory models should be available to students (Richa Bajaj & Vidushi Sharma, 2018). Instructors can set learning models by evaluating the tests that students can take part in and can set different models to help students. Each student can have their learning models that can be created by teachers using e-learning tools (Chang & Ke, 2013).

3.3.2.1 Customisation

One of the ways to customise the learning environment is to give recommendations to students. From that point, they can select the content suggested by RM. By selecting the suggestions, they are giving their preferences to e-learning environments. The learning objective-oriented recommendation mechanism can also create stable recommendations for students. When students access the recommendation section, the suggestions would be more accurate for students. This means that students have control over what they want, and it also eliminates the possibilities of duplication (Wan & Niu, 2018).

3.3.2.2 E-learning in personalisation

E-learning is a form of teaching and learning where students can gain access to study materials through mobile phones, computers, and tablets using the Internet. With this technology, Learning Management Systems (LMSs) can be incorporated into the E-learning. LMSs can be used by teachers to manipulate the content that they wish to put up (Garrido, Morales, & Serina, 2016). This manipulation allows teachers to control the quality of the content (Nikolić et al., 2018). By using LMS and AI, teachers can identify what students want and how they study. A combination of LMSs and AI opens up the opportunities to do research, collaboration, and student-centred teaching and learning (Rodrigues, Isotani, &

Zárate, 2018). E-learning is a part of using AI and LMSs to go forward. E-learning can provide a platform for data mining, evaluation, analysis, and creating content for individuals. With the advancement of AI, e-learning can be taken into a whole new level.

3.4 Expectations of AIED

This section includes the expectations of AIED from humans as described above in section 3.2. The following literature themes shows the flow and connections of the literature. Figure 3 provides the literature themes of the expectations of AI.

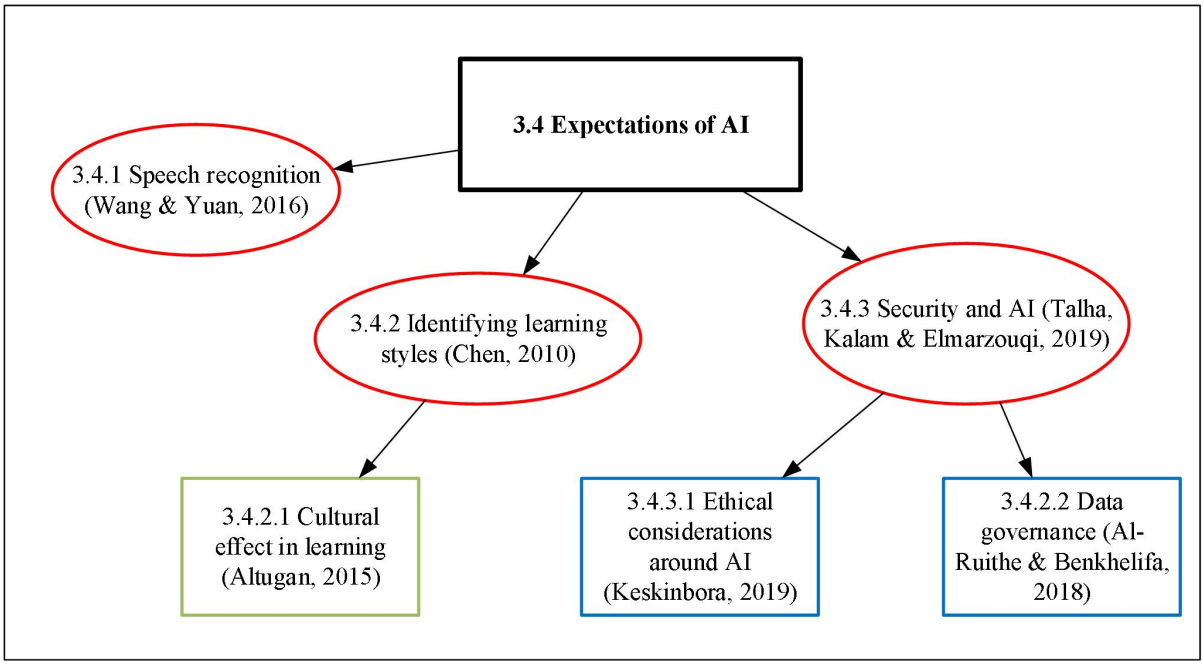

Figure 3. The literature themes of expectations of AI

Humans expect AI to be a teammate and companion to perform tedious and repetitive tasks (Seeber et al., 2019, p. 1).

However, there are many barriers to AIED. For education providers, the primary purpose is to have a system that works well for students. Good applications are the ones that do not interrupt students in anyways and have seamless integration with the existing systems. At this moment in time, the integration to existing LMSs is very hard to accomplish (Seeber et al., 2019, p. 1). The reason why it is hard to accomplish is that current LMSs do not provide a platform for these AI integrations (Graf & Kinshuk, 2009, p. 235).

Another barrier is "A need for structured and systematic approaches to engineering such complex computing systems" (Spano & Boratto, 2019, p. 1).

With the development and progression of AI, there are many expectations from AI. One of the expectations from AI is to be able to identify what the type of students they are. According to Bernard, Chang, Popescu, and Graf (2017), identifying the types of students would benefit them for their study (p. 94). Bernard, Chang, Popescu, and Graf (2017) suggested using the questionnaire to identify their weaknesses and strengths to create a personalised learning environment for students (p. 94). Another expectation is to be able to

understand what students expect and what they want from the AI. To accomplish these expectations, AI should be able to have conversations with human students. By having a natural dialogue with humans, the machine will be able to work out the types of students. For that to happen, AI would need a lot of data processing and data stored in their database.

There are three main parts to Human-Computer Dialogue (HCD), Natural Language Dialogue (NLD), Dialogue Management (DM), and Natural Language Generation (NLG) (X. Wang & Yuan, 2016, p. 303).

3.4.1 Speech recognition

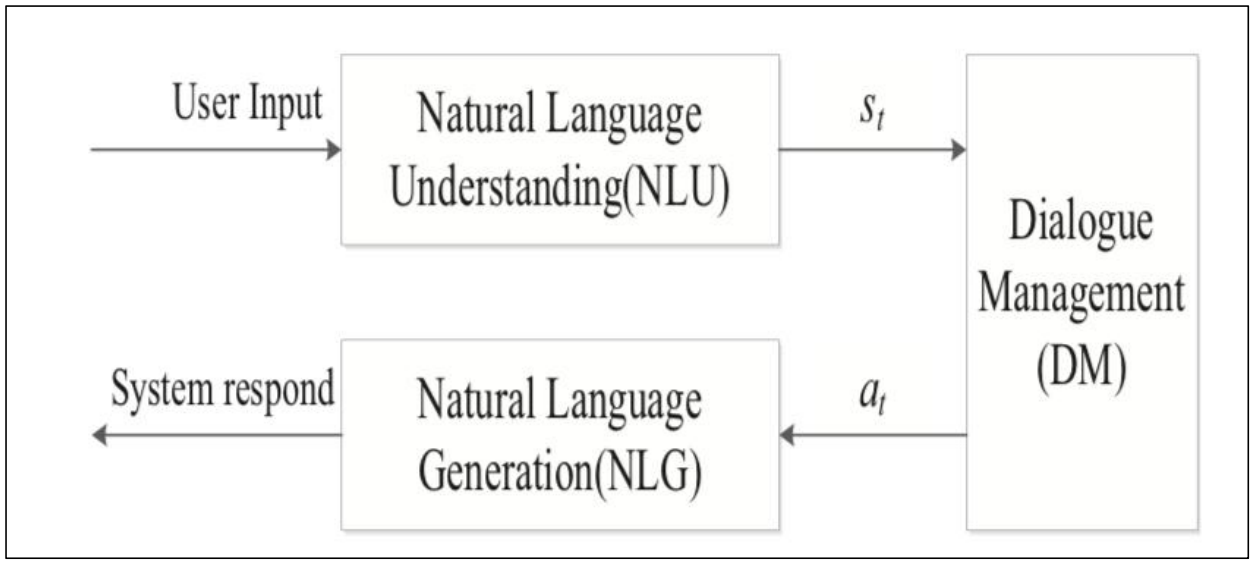

Figure 4. The demonstration of a goal-driven dialogue system. (Source: (X. Wang & Yuan, 2016, p. 304)

According to X. Wang and Yuan (2016), the above image is a goal-driven dialogue system. Firstly, the system needs user input, whether in the form of text or speech (p. 304). To use speech input, students must provide input in the form of speech or verbal information. The system, known as Spoken Language Understanding (SLU is also known as Natural Language Understanding), will then pick up the speech and proceed to the next stage. SLU will have an Automatic Speech Recognition (ASR) to be able to understand students. To be able to understand human input, the ASR must be able to extract the necessary information from the input. If the extracted information is considered to be fully correct or fully observable, the output of NLU or SLU will proceed to Dialogue Management (DM) (X. Wang & Yuan, 2016, p. 304). DM decides whether the information provided by SLU is efficient enough to proceed or clarifications from a user is needed. NLG then generates an output of DM. If outputs were to be speech, NLG should have a Text-to-Speech (TTS) to generate a text to speech (X. Wang & Yuan, 2016, p. 304). All of these steps are to provide students with better learning material and help them achieve their tasks.

3.4.2 Identifying learning styles

As learning methods moving towards student-centred approaches, Self-Directed Learning (SDL) has become the focal point of education (El-Gilany & Abusaad Fel, 2013, p. 1040). These approaches allow students to learn in their own ways. By doing so, students have developed independent learning skills. "Learning styles have been defined as an individual's natural, habitual, and preferred ways of absorbing, processing and retaining new information and skills" (Chen, 2010). Magdalena (2015) also agreed that giving freedom or options to students in terms of SDL and encouraging them to participate in setting their direction create more engaging and proactive learning while increasing the supportive role of teachers rather than the instructive role (p. 1668). Liew, Sidhu, and Barua (2015) mentioned that tailoring the teaching and learning approaches to student's learning styles would be beneficial for students (p. 6).

The articles reviewed indicate that identifying learning styles is important for students for their success. Asiry (2016) suggested that there are four types of learning styles known as (VARK), Visual (V), Aural (A), Reading/Writing (R), and Kinesthetic (K) (p.13). Visual students learn by seeing pictures, videos, graphs, and graphics. Aural students learn from listening to speaking, lectures, and discussions. Readers learn from reading and writing. Kinesthetic students learn from "touching and experience that emphasise doing, physical involvements, and manipulating of objects" (Asiry, 2016, p. 14). According to research conducted by Mantle (2001), there are seven learning styles with four of the above learning styles and three more learning styles. The three learning styles are logical, social, and solitary learning styles. Logical students use logical and mathematical reasoning. This type of learners use strategies and step-by-step procedures to perform tasks (Mantle, 2001). Social students have strong communication with people. They like to learn in groups and work well with other people. They learn from communicating and sharing ideas with others (Mantle, 2001, p. 2). Solitary or Intrapersonal students are private and independent students. They have the ability to work alone and concentrate on finding solutions by reflecting on their past experiences (Mantle, 2001, p. 2). The learning styles of students differ from one another. They can be affected by age, gender, culture, and academic achievement. Asiry (2016) stated that the learning styles of students do not change over the five years of undergraduate students (p. 16). Asiry (2016) also enforced that education providers should look into providing a wide range of teaching methods to students as students have different types of learning styles (p. 16). As the Internet is influencing more on students and teachers, the

profiles of how students learn have changed overtime (Maric, Penger, Todorovic, Djurica, & Pintar, 2015, p. 181). The types of teaching should follow the changes and adapt to new technologies and new kinds of learning methods (Balakrishnan & Gan, 2016, p. 809).

By using questionnaires and tests such as VARK, the different types of learning styles can be identified (Kothaneth, Robinson, & Amelink, 2012, p. 60). One of the expectations of AI should be identifying different kinds of students and providing the necessary materials to students as learning styles are related to cultural identity (Altugan, 2015a, p. 1159).

3.4.2.1 Cultural effect in learning

Altugan (2015a) stated that "the most problematic dilemma in classes is different types of students" (p. 1159). Cultural identities can be determined by individual's nature and nurture "which includes their experiences, talents, skills, beliefs, values, and knowledge, in other words, who they are, what their status is in their family, school, work, environment and country and, beyond that in the world as with globalisation the world is getting smaller" (Altugan, 2015a, p. 1160). Altugan (2015a) also stated that integrating cultural identity into learning is so hard to achieve. As culture can be defined as the lifestyle or personalities of an individual, it is essential to listen to and respect different cultures. "Cultural identity has an important effect on learning and should be taking into consideration while teaching and learning" (Altugan, 2015a, p. 1161). Švarcová and Jelínková (2016) also stated that it is vital to know each individual's learning approaches and styles so that teachers can support and identify differences and similarities between students (p. 182). Ventura and Moscoloni (2015) supported the idea of teachers providing alternative instructions to different types of students (p. 92).

3.4.3 Security and AI

"Data Mining is advantageous in the field of education, especially when examining student's learning behaviour in an OLE" (Mohamad & Tasir, 2013, p. 320). An extensive database should be in place to collect and store significant data. AI would need lots of data to create a personalised learning environment. Besides, AI might have to track all the activities of students to create such a sophisticated platform. Just providing a little bit of data would not be enough for AI, thus create a big concern for security. Security and big data are still a significant security concern for many people, as researchers look to research how to protect big data and how to use big data analysis. Security and privacy research have been done on big data, cannot be considered as extensively researched fields (Q. Liu, Srinivasan, Hu, & Wang, 2017, p. 206). Vincent and Creteur (2019) stated that collecting a large amount of data is necessary to make sure that the quality of data is good (p. 340). Vincent and Creteur (2019) also mentioned that privacy and security are still a big concern as the big data is here to stay (p. 340). There are also many issues around data exploitation (Talha, El Kalam, & Elmarzouqi, 2019). To make sure that the right data is collected, intricate mechanisms and strategies should be in place (Talha, El Kalam, & Elmarzouqi (Talha et al., 2019, p. 916). Having useful data suggests that a large amount of data should be collected. However, collecting that much data is a concern for security and privacy (Talha et al., 2019, p. 921).

3.4.3.1 Ethical consideration around AI

Keskinbora (2019) pointed out that ethical considerations should be taken into consideration when it comes to AI (p. 277). There should be a feature that allows humans to take control of AI. Keskinbora (2019) suggested the five principles, Transparency, Credibility, Auditability, Reliability, and Recoverability (p. 278). Transparency is that AI's operations should be visible to students. So that humans can see everything AI is doing at any time (Keskinbora, 2019, p. 278). AI should be able to perform incredibly well, meaning that outcomes are acceptable to students. If students do not want AI to access their information on devices, there should be a feature that prevents AI from accessing user's data (Keskinbora, 2019). Auditability is that AI's efficiency can be measured (Keskinbora, 2019). Reliability is that AI should perform as intended (Keskinbora, 2019). Recoverability means that students should be able to take control when required (Keskinbora, 2019). Vidgen, Hindle, and Randolph (2019) also mentioned that the ethical dimension should be in place regarding AI

(p. 1). There should be guidelines to create trust around humans and new technology (Langer, Feingold-Polak, Mueller, Kellmeyer, & Levy-Tzedek, 2019, p. 231).

3.4.3.2 Data governance

To make sure that the private and sensitive information is kept safe, managing data and governing sensitive data should be an essential part of AI. There are still many complexities around Data Management (DM). Data governance is one of the most suggested solutions for managing data (Al-Ruithe & Benkhelifa, 2018). Data governance and data mining can be used to consider the learning behaviour of students (Mohamad & Tasir, 2013). As mentioned in section 3.4.3 (Security and AI), big data collects a large amount of structured and unstructured data from various devices such as personal computers, mobile phones, and traffic cameras (Tawalbeh & Saldamli, 2019). These data should be safe and protected from hackers and other malicious activities. Data governance can assure the safety of data as only necessary data are allowed to use. As there is no significant development around data governance and data management, these issues still present (Tawalbeh & Saldamli, 2019).

3.5 Literature findings

Table 1 provides a summary of the authors, year of publication and findings of literature in a table format.

Table 1

The Literature Findings with the Authors and Year of Publications

Literature findings	**Author and date of publication**
Students learn differently	(Alaoutinen, 2010)
Cultural differences and learning styles	(Alaoutinen & Smolander, 2010)
Chatbots	(Alin-Andrei, 2018)
The use of data governance and data mining in finding out the learning behaviour of students.	(Al-Ruithe & Benkhelifa, 2018) (Mohamad & Tasir, 2013)
People with dyslexia learn from feeling and mental images	(Alsobhi et al., 2015)
AI should understand that learning styles relate to cultural identity	(Altugan, 2015a)
Four types of learning styles (VARK)/ learning styles not change over a short time	(Asiry, 2016)
Learning theory models to be available to students	(R. Bajaj & V. Sharma, 2018)
students adapt to using new technologies	(Balakrishnan & Gan, 2016)
Identifying a type of students would be beneficial for students	(Bernard et al., 2017)
Providing a diverse platform	(Blank et al., 2003)
Different learning styles affect student's performance	(Chamillard & Sward, 2005)
E-learning	(Chang & Ke, 2013)
Learning styles	(Chen, 2010)
Consideration of student's learning styles	(DorÇA et al., 2016)
Complex computing systems	(Spano & Boratto, 2019)
Self-directed learning	(El-Gilany & Abusaad Fel, 2013)
Tutors to have control over LMS and content creation	(Garrido et al., 2016)

Visual analysis	(González-Torres et al., 2013)
LMSs cannot be catered for everyone/ LMSs do not provide platform for AI integration	(Graf & Kinshuk, 2009)
Performance Tracking systems/ Personalised learning environment/ Recommendation module	(İçöz et al., 2015)
Adaptability	(Jaimes & Sebe, 2007)
Ethical considerations regarding AI	(Keskinbora, 2019)
Tests and questionnaires used to identify different types of learning styles	(Kothaneth et al., 2012)
Personalised environment/ Performance tracking system/ AI to create personalised learning environment	(Kurilovas et al., 2014)
Creating trust is important for AI and students	(Langer et al., 2019)
Not many research have done on big data	(Q. Liu et al., 2017)
Self-directed learning	(Magdalena, 2015)
Seven types of learning styles	(Mantle, 2001)
Internet changed the way students learn	(Maric et al., 2015)
Data mining	(Mohamad & Tasir, 2013)
E-learning environment, Performance tracking systems	(Nikolić et al., 2018)/ (Verma, 2018)
Providing OLE for students	(Popenici & Kerr, 2017)
Human behaviour towards computers and colleagues	(Posard & Gordon Rinderknecht, 2015)
Research, collaboration and student-centred teaching and learning	(Rodrigues et al., 2018)
Five subsystems to identify types of students	(Samarakou et al., 2015)
Computers to be teammates / AI to do tedious and repetitive work / integration of LMS hard to achieve at this moment	(Seeber et al., 2019)
Students to be a focal point of technology development	(Soares et al., 2014)

Recommender systems	(Spano & Boratto, 2019)
Tutors to know individuals' learning style	(Švarcová & Jelínková, 2016)
Data exploitation	(Talha et al., 2019)
Big data collects everything	(Tawalbeh & Saldamli, 2019)
AI cannot create contents and guidelines	(Verma, 2018)
Tutors should provide alternative instructions	(Ventura & Moscoloni, 2015)
Ethical dimension	(Vidgen et al., 2019)
Data quality	(Vincent & Creteur, 2019)
AI can offer new technologies/ Customisation for students	(Wan & Niu, 2018)
Recommendation module	(Q. Wang et al., 2017)
Building a large number of labelled data is not feasible / Human-computer dialogue / Natural language dialogue/ Dialogue management/ Natural language generation	(X. Wang & Yuan, 2016)
Chatbots lack communication skills	(Yan et al., 2018)

3.6 Conclusion

Computers have been a part of education for over 20 years. Attempting to employ AIED is the next step. However, there lie many issues, as discussed above. One of the issues is the cost to develop such complex systems. On the other hand, a promising advancement of AI is affecting education as recent research show. Learning environments that are facilitated towards student-initiated learning that can assess and diagnose students' works prove that even with many limitations, overcoming these issues is possible. AI technologies that are driving towards helping students by personalisation, performance tracking and RMs try to provide an environment where students can improve their performances by using these technologies. On the other hand, there are also possible concerns such as security, cultural differences, and different types of learning styles that may prove to be obstacles for students, teachers, and AIED.

This chapter explored the AI technologies that could be useful in education as well as possible issues surrounding the implementation of AIED. Furthermore, the different types of AI technologies such as performance tracking systems, personalised recommendations,

customisation, e-learning, the types of learning styles, speech recognition, and ethical considerations were discussed in this chapter.

The next chapter describes the methodology, philosophical world view, research design, hypotheses development, and conceptual framework used in this research. The sample size, sampling, population, and research method are also presented as this is survey research. Since this is a research conducted by only one researcher, the limitation, reliability, and validation are also looked at in the next chapter.

4. Research Methodology

An overview of the chapter

This chapter includes the introduction to the research method, the philosophical worldview, the research design, the hypotheses development, the conceptual framework, the questionnaire design, the sampling method, limitations, reliability, and validity of this research. The aim of this chapter is to inform the type, processes, and detailed description of this research along with where the hypotheses sit on the conceptual framework.

The independent and dependent variables are also presented in tables (see Table 2 and Table 3).

4.1 Introduction

This chapter starts with the design of the research. The flow of the research shows an overview of the steps of this research in order. The conceptual framework provides the outline for testing the hypotheses against the research questions and literature review. The survey question design is also included with the measurement scale related to the research variables. The sampling, sample size, and population considered for this research are all presented in this chapter.

4.2 Philosophical worldview

A philosophical worldview adopted in this research is called the post-positivist worldview. This research focused on identifying the effect of AIED as the outcome can be assessed by observing and measuring the variables. By determining the outcome, the influences that determine the outcome can be identified.

Post positivist worldview encompasses determination, reductionism, empirical observations and measurement, and theory verification (Creswell, 2014). These four elements are vital parts of this research.

Post positivist is a balance between positivist and interpretivist approaches. Instead of finding out what majority of people say is true, it rather looks at the past, the issues surrounding the research and possible new ideas. So that there is no absolute true can never be found in post-positivism (Panhwar, Ansari, & Shah, 2017).

4.3 Research design

This research aimed to identify the factors that AI would have an effect on student's performance, fulfil its tasks, function as intended, and usage of AIED from a student's point of view. The research also looked at the effect of independent variables on dependent variables.

The conceptual framework that is used in this research is called the Task-Technology Fit model (TTF) (Dishaw & Strong, 1999). The main purpose of using the TTF model is that the TTF model has an aspect of finding out individual performance, which is one of the main interests of this research. Furthermore, the TTF model has three main aspects, the task requirements, the functionality of tools, and the effectiveness of the tool or the individual performance.

This research utilised the TTF model and tried to understand the relationship between independent variables (age and gender) and dependent variables values (students' perspectives of AI and willingness to use AI with the level of agreement (i.e., strongly agree/ agree, neither agree nor disagree or neutral, and strongly disagree/ disagree)). Tables describing the variables are provided below.

This table (see Table 2) shows the independent variables of this research.

Table 2

The Independent Variables

Independent Variables	Abbreviation	Definition
Gender	G	Gender of participants
Age	A	Age of participants
Role	R	Role of participants in education
Platform	P	Devices used for study

This table (see Table 3) includes the three dependent variables and the research variable values of agree, neither agree nor disagree, and disagree to questions of the survey conducted to gather data for this research.

Table 3

The Dependent Variables and their Values

Dependent Variables	**Research Variable Values**	**Abbreviation**	**Definition**
Tracking Systems	Strongly Agree /Agree	SA/A	Having the same opinion about AI
AI Technologies	Neither agree nor disagree / Neutral	N	Not having the same nor different opinion
Expectations of AI	Strongly Disagree/ Disagree	SD/D	Having the different opinion about AI

4.3.1 The flow of the research

The flowchart (see Figure 5) provided below shows the steps and the flow of this research.

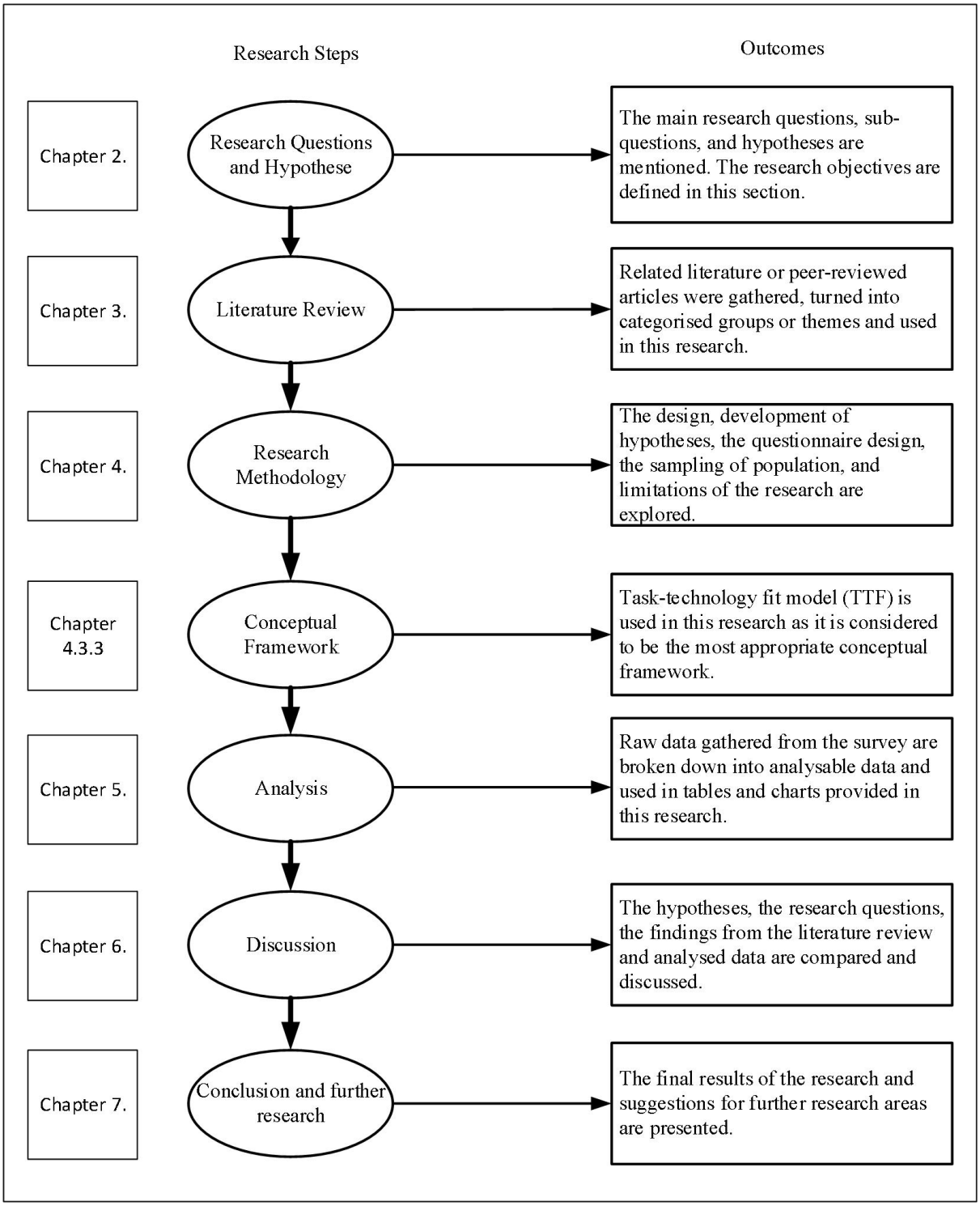

Figure 5. The research steps of this research

4.3.2 Hypotheses development

There are six hypotheses to identify the relationship between the expectations of AI from students and the usefulness of AIED. In the following section, a discussion on how these hypotheses were developed is presented.

H1: Students who use AI will have better performance.

H1 is developed to determine the fact that students' points of view on individuals who use AI will have better performance. This hypothesis is developed to consider the facts that influence of AI have on students and how they can utilise AI for their benefits.

H2: Students who do not use AI will have better performance.

This hypothesis is the opposite of H1. Even though technologies have changed the way, students study, the principal of learning is still the same as teachers should know the effective ways to implement the technology in teaching (Protheroe, 2005, p. 48). Many students do not need technology as much for their studies. This hypothesis is developed to consider the fact that AI is not a complete necessity for students.

H3: Students will not feel safe using AI online tracking systems.

This hypothesis is developed to consider the fact that safety and privacy might be a concern for students who use online tracking systems. The online tracking systems offer a wide range of benefits as AI can get a massive amount of data from a user's activity. This will help AI to make better decisions as to what students want as regards to provide quality content.

H4: AI is a useful tool for students.

This hypothesis is developed to consider the fact that AI will be a tool that students can use in their daily lives without any harm. AI may be able to provide a safe OLE for students and become a companion for students.

H5: AI is a tool that students do not need for their study.

This hypothesis is the opposite of H4. This hypothesis is developed to consider the fact that AI might be a tool that is available for students; however, AI does not offer any benefits for students and a hard to use application.

H6: AI will be a distraction for students.

This hypothesis is developed to consider the fact that instead of offering benefits for students, AI will get in the way of students while studying. AI may be a distraction for students and an unsafe online tool that has no benefits for students.

4.3.3 Conceptual framework

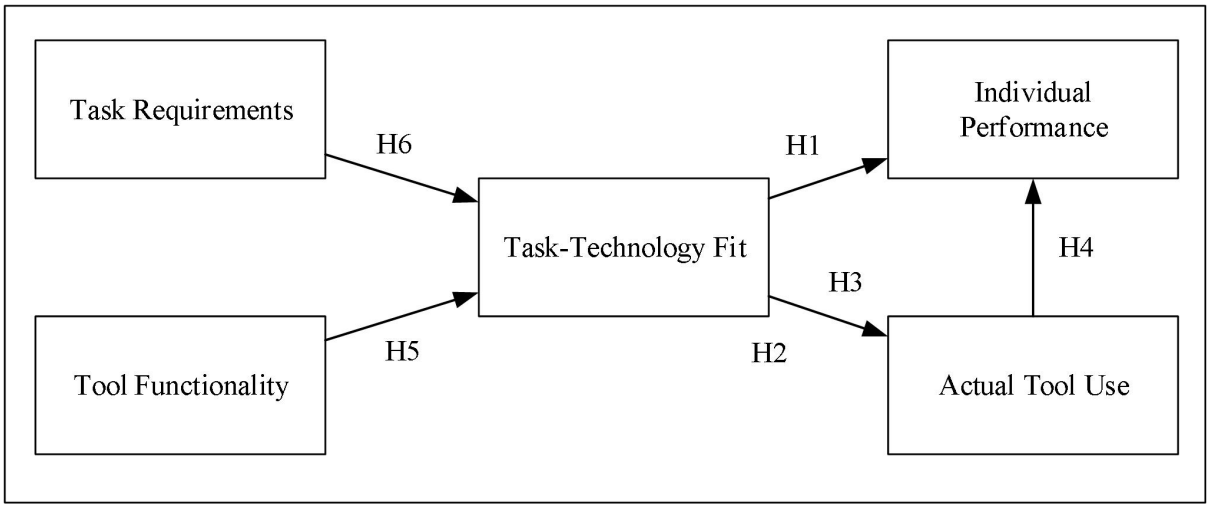

Figure 6. The TTF conceptual framework with hypotheses (Adapted from: Dishaw and Strong (1999, p. 11))

The above conceptual framework (TTF) with hypotheses shows where hypotheses sit on the framework as shown in Figure 6.

The meaning of the task requirements of the TTF model is that an application developed for the task should perform as intended. The tool functionality is to provide an environment or a platform for the task to complete. When these two align, the technology fits its purpose, or the task can be completed. Once the task is completed, it is likely that the tool will be used again as the tool serves its purpose, meaning that the actual tool use will be affected by how the tool can perform a task repeatedly. If the actual tool use seems to be affected positively, the individual performance will likely be increased. Even if the tool functionality aligns with the task requirements, the actual tool use could affect the individual performance depending on how the tool was used in the first place (Dishaw & Strong, 1999, p. 12).

H1 sits on the individual performance, and the task-technology fit join. The reason behind, H1 is on the individual performance, and the task-technology fit join is that the AI will be beneficial for students as AI fits the task requirements and the tool functionality.

H2 sits on actual tool use and task-technology join. The reason behind H2 is on the actual tool use, and task-technology join is that even though AI fits the task requirements and the tool functionality, students do not use AI, or they use AI in a different way than intended.

So that the effect of AI has on students cannot be considered as the effect of AI on their performance.

H3 sits on actual tool use and task-technology fit join. The reason behind, H3 is on the actual tool use, and task-technology join is that AI fits the task requirements and the tool functionality, however, students do not use AI as they do not feel safe due to the lack of security measures implemented in AI.

H4 sits on actual tool use, and individual performance join. The reason behind H4 is on the actual tool use, and individual performance join is that AI is a tool that is useful and helpful for students without any harm. Students use AI, and their performances are affected in a positive way.

H5 sits on task requirements, tool functionality, and task-technology fit join. The reason behind, H5 is on the task requirements, tool functionality and task-technology fit join is that AI cannot provide quality content and is a massive security concern as AI does not fit the tool functionality. So that AI does not fulfil the task-technology fit.

H6 sits on the task requirements and task-technology fit join. The reason behind, H6 is on the task requirements and task-technology fit join, is that AI does not fit the task requirements as AI cannot provide any benefits for students.

4.3.4 Nature and type of research

This research design uses a correlational design in which "investigators use the correlational statistic to describe and measure the degree or association (or the relationship) between two or more variables or sets of scores" (Creswell, 2014).

Survey research was conducted to gather the answers from participants. Survey research provides opinions of a population by studying the sample of the population (Creswell, 2014).Survey research tends to include cross-sectional and longitudinal studies using questionnaires.

4.4 Questionnaire design

The survey consisted of 13 questions. The researcher created the survey questions to get the best answers within a short amount of time. The typical time spent for this survey research was two minutes and 23 seconds, according to SurveyMonkey.com. Having easy to answer and clear questions were the key objective of this survey.

The research questionnaire was based on the research variables. The questions were used to identify the relationship between the contributing factors (independent variables) and level of agreement (dependent variables).

A questionnaire with the thirteen survey questions was created using SurveyMonkey.com. The following table (see Table 4) provides a link between research variables and their corresponding survey questions. The measurement type is also included in Table 4. The variable values of tracking systems, AI technologies, and the expectations of AI are in a three-point scale format (see section 5.4.3).

Table 4

The Research Variables with the Corresponding Question Numbers and Measurement Types

Research Variables	Variable Values	Questions Numbers	Measurement Scale
Gender	G	Q1	Nominal
Age	A	Q2	Ordinal
Role	R	Q3	Ordinal
Platform	P	Q4	Nominal
Tracking Systems	SA/A, N, and SD/D	Q5, Q9	Ordinal
AI Technologies	SA/A, N, and SD/D	Q6, Q7, Q8, Q10,	Ordinal
Expectations of AI	SA/A, N, and SD/D	Q11, Q12, Q13	Ordinal

The questionnaire can be divided into two sections. The first set of questions consists of independent variables (Gender, Age Groups, Role, and Platform). These questions are to collect the demographic characteristics of the participants. The second set of questions (Q5 – Q13) is to collect the participant's opinions and perspectives of AIED and their willingness to use AI.

The measurement scales or types are used in this research to allow mathematical comparisons (Zikmund, 2009, p. 296). There are four types of measurement scales, nominal, ordinal, interval, ratio (Zikmund, 2009, p. 298). They provide different information depending on the type of scales. Two main types of measurement scales are used in this research, nominal and ordinal. A nominal scale "assigns a value to an object for identification or classification purposes only" (Zikmund, 2009, p. 297). Nominal scales are used to identify things rather than giving value or ranking to a property.

Ordinal scales are used to rank objects. This scale is useful to get a participant's opinions on how they view or feel about AIED. The next section discusses the factors behind asking questions five to thirteen.

4.4.1 The descriptions of survey questions

As mentioned above, there were 13 questions in the survey. The first four questions of the survey were to get answers regarding gender and age groups of participants also the role or the position of participants in education and the platform or digital devices that they would use to study. Q5 to Q13 was to capture the opinions of participants on AIED.

4.4.1.1 The description of Q5

Q5 was about the effect of the implementation of AI performance tracking systems in education as the tracking systems provide better guidelines and can steer students in the right direction. As described by McNelis, Horton-Deutsch, and Friesth (2012) students would get more benefits from using data and Information Technology (IT) together to create an experience for students who would be more likely to use such technologies with ease later on (p. 362). McNelis, Horton-Deutsch, and Friesth (2012) also pointed out that by using tracking systems, students could get the reflection on how they did on their tasks (p.363). McNelis, Horton-Deutsch, and Friesth (2012) also mentioned that having tracking systems would give students the confidence without worrying about things going wrong as tracking systems would guide students to do the right thing (p. 363). However, getting the answer from participants would provide whether they would be comfortable using tracking systems or not.

4.4.1.2 The description of Q6

The intention of asking Q6 was to understand the current state of LMSs and what participants' thoughts are on the improvement of their performances using LMSs. Creating such platforms or LMS that could support the needs of students in terms of finding quality content and a visually pleasing environment, the magnitude of data required to perform such tasks was enormous. One of many ways to support the necessary data was to mine data. Data mining suggested by Lerche and Kiel (2018) could support the required data (p. 368). Using data mining, AI would be able to predict the achievement of students (p. 367). The answers to this question would provide insights into what participants' thoughts were on Q6.

4.4.1.3 The description of Q7

Asking Q7 was to get an idea of what respondents thought about the RM. As stated in section 3.3.1.1, RMs could be used for providing a list of suggestions based on what students preferred. For those participants who were not familiar with the term RM, a description of RM or RS was provided in Q7.

4.4.1.4 The description of Q8

Q8 asked participants' perspectives on AI tutors. This question was included to get an idea of whether they would use AI tutors that could give instant feedback. Describing the tasks of AI tutors was to make sure that they were aware of what AI tutors could do for them.

4.4.1.5 The description of Q9

The reason behind asking Q9 was related to the safety or security of students. If AI tracking systems were tracking every activity of students, using such applications would raise security concerns. On the other hand, the system could be used in another way. As suggested by Langheinrich (2002), once tracking systems had been employed in the user's online environment, the tracking systems would make sure that the usage of user's personal information by third parties would be tracked and alerted to students if the misuse of information was detected.

4.4.1.6 The description of Q10

The next question was Q10. Q10 asked if participants would use Chatbots. Brandtzaeg and Følstad (2018) mentioned that Chatbots would be the next big thing in the IT world (p. 40). Brandtzaeg and Følstad (2018) also mentioned that HCI was already in its way to become one of the most useful technology as Chatbots already could communicate with students in the form of messaging via mobile devices (p. 38). Answers from this question could suggest whether participants viewed Chatbots as applications that had shown them that they could communicate with them or not.

4.4.1.7 The description of Q11, Q12 and Q13

Q11, Q12, and Q13 asked if participants would use the technologies mentioned above were available to them and proven to have a positive impact on education as well as asking participants that AI could provide a better learning experience of students.

The next sections discuss the research method, population, and sampling method used in this research.

4.5 Research method

The objective of this research was to identify the relationship between AI and its effect on education. Furthermore, students' points of view on AIED was also explored.

Due to the lack of funds and time available to conduct this research, the online survey method was the chosen method. Doing an online survey ensured that the researcher did not intervene in participants' views of the questions in any way. The online survey was conducted in a four-week time. The results gathered from the survey were used to identify the answers to the research questions mentioned above. The results were then stored in the form of raw data for analysis later on.

The next sections discuss the sampling, population, data gathering, and analysis. The correlational research was conducted under uncontrolled settings and minimal interference by the researcher to ensure that there are no bias answers to the questions.

4.6 Population

The population considered for this research was 500. This number was chosen to make sure that there are significant results to answer the research questions. As suggested by Universities New Zealand, approximately there was one university for 500,000 people, which was in line with an international standard for tertiary education. Due to the lack of funds and time, the sample size chosen was a fraction of 500,000, which was 0.1% of population size that resulted in a population of 500. The target population was over the age of 18.

4.7 Sampling

A nonprobability sampling (convenience sampling) is based on the convenience and availability of participants (Creswell, 2014). A convenience sampling method was chosen to ensure that as many participants as possible were able to participate in this survey research as the survey was limited to four weeks only.

4.8 Sample size

"Survey research provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population" (Creswell, 2014). As stated above, the population chosen for this research was 500. With the lack of funds and time, the population of 500 was the most appropriate number and considered to be a significant number for this research.

When considering the population sample, there are three things to take into consideration the margin of error, a confidence level, and the size of the population. With the population size of 500, a confidence level of 95%, and the margin of error of 4%, the sample size needed to conduct this research was 273. The resulted number 273 was determined by using the sample size calculator from the website surveymonkey.com (see Figure 7). Figure 7

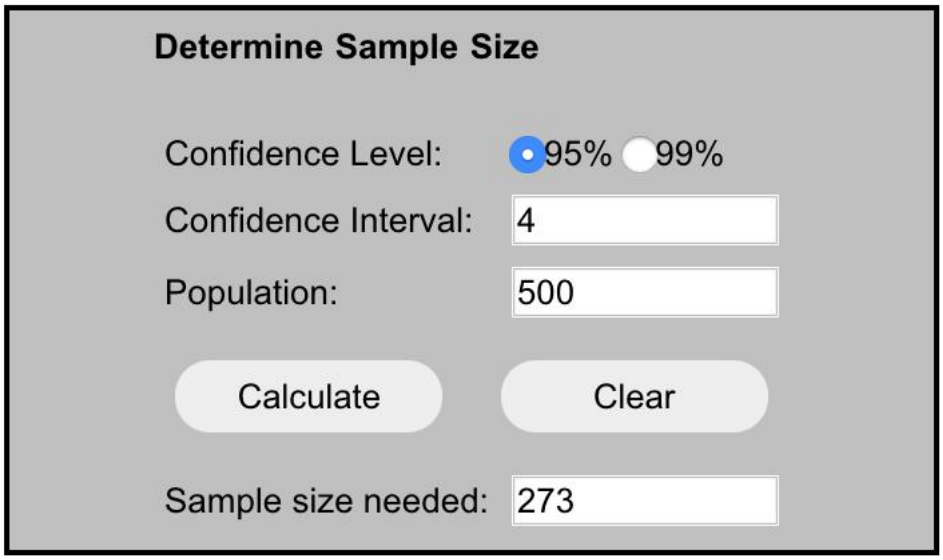

Figure 7. The sample size calculator (Source: SurveyMonkey.com)

shows the result of sample size calculator.

4.9 Data collection

Data was collected using an online survey. The weblink containing the survey was sent through social media such as Facebook, Viper, and WhatsApp. Since the survey research was a convenience survey research, the participants were also allowed to share the survey link with their friends and family. The survey link was available to participate and answer for four weeks after receiving the ethics approval from the ethics committee of Waikato Institute of Technology (Wintec).

4.10 Reliability and validity

The reliability means that the measurement's scale is consistent and reliable, meaning that the data gathered from different attempts at measuring should produce the same result. The researcher's approach should be consistent across different researchers (Creswell, 2014). As mentioned by Creswell (2014), this research followed the rules of conducting survey research, as mentioned in section 4.8 Sample Size and the use of dependent and independent variables.

"Validity is the accuracy of a measure" (Zikmund, 2009, p. 307). When measuring the accuracy of the data, the measurement should be accurate. The findings of the research should be accurate by controlling certain elements of the research (Creswell, 2014). The survey had a consistent way of gathering answers, as stated in section 4.4.

As mentioned above, the population needed for this research to be statistically significant was 273. However, with the limited time-frame of four weeks of a survey link activation, only 143 of responses were collected. Therefore, the target of 273 was not met; thus, the survey was statistically insignificant. Since the survey was not statistically significant, the results obtained from the analysis cannot represent the whole population of 500,000.

4.11 Limitations

One of the limitations of doing online survey research is that the required participant number may or may not met the sample size. The number of participants needed for this research to be statistically significant was 273. However, only 143 participants participated in this research, meaning that the results gathered do not represent the whole population of 500.

The other limitation is the time available for this survey. Only four weeks of survey activation was allowed for this research as time was a constraint.

There are many limitations when it comes to doing online survey research. One of them is data accuracy. As participants were allowed to answer the questions without any supervision from the researcher, the misunderstanding or misinterpretation could result in giving incorrect and indecisive answers.

Even though this survey does not include any personal questions, some might feel uncomfortable answering some questions. This could also contribute to the fact that results in a lack of responses from participants.

4.12 Conclusion

In this chapter, a description of the development of the hypotheses and methodology used for this research were discussed. The flowchart showed the steps of this research. The importance of a conceptual framework called Task-Technology Fit model (TTF) for this research and how hypotheses sat on the conceptual framework as well as the considerations of sample size and sampling of the population with how questions were created to capture the independent and dependent variables were all presented in this chapter.

As the total number of participants did not meet the required number 273, the discussion of limitations, reliability, and validity as well as how the data was collected were included in this chapter.

The next chapter looks at how data retrieved from participants was analysed by using data analysing tools and the descriptive analysis of data using chi-square, pie-charts, and radar charts. By profiling the participants using the pie-charts, the distribution and frequency of gender and age of participants are captured. The calculation of respondents' and non-respondents' ratios and the number of questions answered by participants are shown in Table 9 and Table 10. The next chapter explains the detailed analysis of the results based on gender, age, and the sequence of questions.

5. Analysis

An overview of the document

This chapter includes the introduction to the data analysis, the profile of participants, and the descriptive analysis performed on the data set retrieved from the survey. The types of tools and assigning the numbers to the questions to make the process of analysing easier are discussed in this chapter. Figures and tables are used to analysis, calculate, display, and present the findings or outcomes.

5.1 Introduction

This chapter discusses the analysis performed on the data received from the survey conducted for this research. This chapter can be divided into two parts, one of which includes the raw data gathered from the survey, the profile of participants, the data analysis tools, the coding or the assignment of numbers to the questions, measurement instruments, and the extraction of data. The other part includes the descriptive analysis of data using the pie-charts, radar charts, and the tables to present the data. The second part uses and analyses the gender, age groups, and responses for Q5 to Q15 as data. The second part can also be separated into two parts. The first part looks at the responses and turns into figures by analysing data. The second part calculates the P-values and finds out the significance between the independent and dependent variables.

Sections 5.2 to section 5.6 discuss the instruments and measurement types used for this research. From section 5.7 to 5.8, discuss the detailed analysis of data and present the results using tables and figures. At the end of each group's analysis based on gender and age groups, a table displays the results or findings from the analysis using P-value of Chi-square test. In section 5.9, the conclusion for this chapter is presented.

5.2 Raw data

Turning the responses from participants into manageable data was done by using an Excel spreadsheet. The data received from the participants were in the form of raw data. The individual responses were then turned into a filtered database (an example of raw data is presented in section 5.4.3).

5.3 Profile of participants

The survey link was sent to the researcher's friends and family through social media, as stated in section 4.9. For the understanding of the profile of participants, Q1 to Q4 was included in asking their gender, age groups, the platform they would use to study, and the role that defines their position in education. Table 5 provides a summary and percentages of the participant's profile in terms of gender, age groups, the role, and the platform.

Table 5

Independent Variables and the Percentages of the Whole Respondents' Population (143)

No.	Description	Selection	Total Percentage of Respondents' Population
1.	Gender	Male	32.9 %
		Female	66.43 %
2.	Age Groups	18 - 24	44.75 %
		25 - 34	23.78 %
		35 – 44	15.38 %
		45 – 54	14.69 %
		55 – 64	0 %
		65 +	0.70 %
3.	Role	Teacher	5.59 %
		Student	48.25 %
		Studied within 5 years	21.68 %
		Studied over 5 years ago	16.78%
		Others	7.69 %
4.	Platform	Mobile devices	22.38 %
		Tablets	7.69 %
		Desktops	14.70 %

		Laptops	52.45 %
		Others	2.80 %

As shown in Table 5, there were more female participants than male participants when looking at the percentages of male and female respondents. Smith (2008) also found out that females were more likely to answer a survey even though the population of the female was significantly less than the male population in his research (p. 9). Saleh and Bista (2017) backed the claim of females being more inclined to answer the online survey (p. 69).

The aim of Q1 was to collect the participants' age by providing a range of age groups. Collecting the age of participants would provide valuable information as the researcher could gather the demographics of participants. The categorisation of age groups was important to understand the effect of age in using AIED.

The participant's gender was also collected. Once again, gender could provide vital information as to which gender was more inclined to use AIED and what the majority of the participant's gender was.

Their roles in education also provided the key element to this research, even though this research was not statistically significant. Students and the participants who studied within five years were the most participated (as seen in Figure 5). Therefore, this research reflected the perspective and acceptation of AIED from the majority of participants who were students and who studied not long ago.

The platform of which participants used to study provided the significance of devices being light, mobile to carry, and useful at the same time. The statistics of the platform indicated that laptops and mobile devices were the most used devices as 52.45% and 22.38%, respectively.

5.4 Data analysis tools

The sections below discuss the tools and instruments used to analyse the data retrieved from the survey. Using these tools helps to manage and present the data.

5.4.1 Assigning numbers to the survey answers (Coding)

The survey consisted of 13 questions. The answers were assigned with the codes or numbers to simplify further to a manageable data set. The table provided below (see Table 6) discusses the corresponding questions and codes (numbers).

Table 6

Assigning the Numbers to the Survey Answers (Coding)

Survey Questions No.	Description	Selectable Answers	Codes
Q1.	Gender	Male	1
		Female	2
Q2.	Age Groups	18 - 24	1
		25 - 34	2
		35 – 44	3
		45 – 54	4
		55 – 64	5
		65 +	6
Q3.	Role	Teacher	1
		Student	2
		Studied within 5 years	3
		Studied over 5 years ago	4
		Others	5

Q4.	Platform	Mobile devices	1
		Tablets	2
		Desktops	3
		Laptops	4
		Others	5
Q5.	AI performance tracking systems for student's performance	Strongly Disagree/ Disagree	1
		Neutral	2
		Strongly Agree/ Agree	3
Q6.	OLE for students' preference to improve students' performance	Strongly Disagree/ Disagree	1
		Neutral	2
		Strongly Agree/ Agree	3
Q7.	Recommendation module	Strongly Disagree/ Disagree	1
		Neutral	2
		Strongly Agree/ Agree	3
Q8.	AI tutors for instant feedback	Strongly Disagree/ Disagree	1
		Neutral	2
		Strongly Agree/ Agree	3
Q9.	Safety and AI online tracking system	Strongly Disagree/ Disagree	1
		Neutral	2
		Strongly Agree/ Agree	3
Q10.	Chatbots as helpline	Strongly Disagree/	1

		Disagree	
		Neutral	2
		Strongly Agree/ Agree	3
Q11.	Effectiveness of AI	Strongly Disagree/ Disagree	1
		Neutral	2
		Strongly Agree/ Agree	3
Q12.	AI to provide a better learning experience	Strongly Disagree/ Disagree	1
		Neutral	2
		Strongly Agree/ Agree	3
Q13.	To use AI if available	Strongly Disagree/ Disagree	1
		Neutral	2
		Strongly Agree/ Agree	3

From Q1 to Q4 was to retrieve the profile of participants, as stated in section 5.3. From Q5 to Q13 was to collect the participants' opinions on AIED. Q5 to Q13 used the three-point scale rather than a five-point scale to simplify the answers.

5.4.2 Measurement instruments

From Q5 to Q13 were the five-point scale questions. Five-point scale questions provided a participant with five options, of which participants only allowed to answer one, as shown in Table 7. This scale captured a participant's opinion by providing the range of strongly agree (1) to strongly disagree (5). Providing a range to choose for participants made answering the questions less complicated and time-consuming.

Table 7

An Example of a Question Statement and a Range of Responses

Question Statement	Would you use AI technologies if they were available?				
Responses	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	1	2	3	4	5

5.4.3 Extraction of data

The responses were converted into an Excel spreadsheet. Each one of the participant's answers was turned into a form of data (an Excel spreadsheet) that was used in the Excel application by using the coding system mentioned in section 5.4.1. The answers for Q5 to Q13 were turned into three dependent variable values or three-point scale (Strongly Agree/ Agree (SA/A), Neutral (N), and Strongly Disagree/ Disagree (SD/D) rather than the five dependent values or five-point scale (Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree) to simplify further. An example of data extraction was provided in Table 8. The data provided in Table 8 was using the five variable values for Q5 to Q13.

Table 8

An Example of Raw Data Retrieved from the Survey

Respondent	Gender	Age Group	Role	Platform Use
1	1	2	2	4

Respondent	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	3	3	4	2	2	4	4	3	4

5.5 Number of participants

There were 143 respondents. However, not everyone answered all the questions of the survey. All the respondents answered from Q5 to Q13. One participant skipped the gender, and age group.

Table 9

Questions Answered by the Number of Participants

Number of Respondents	Questions Answered
1	Q3 – Q13
142	Q1- Q13

Although, the targeted number of participants was 273, as mentioned in section 4.8, only 143 participants answered the questions. Table 10 shows the percentages of respondents and non-respondents.

Table 10

The Sample Size and the Percentages of Respondents and Non-respondents

	Population	Percentage
Sample size needed	273	100%
Respondents	143	52.4%
Non-respondents	130	47.6%

5.6 Response bias

"Response bias is the effect of non-responses on survey estimates" (Creswell, 2014). As stated in section 5.5, only 143 answered the survey. There were questions of "what if other 130 non-respondents or unanswered surveys were answered?" and "would these non-respondents change the overall results?". As Scott et al. (2011) found out, when conducting an online survey, it was likely that respondents would not answer the online survey compared to sequential mixed mode in which the survey was sent to participants using login details to answer and personal invitation letter with an option to request the physical paper survey, and simultaneous mixed mode in which the survey was sent to participants using vice versa method to sequential mixed-mode (p. 4). Scott et al. (2011) also found out that participants were most likely to complete other forms of the survey rather than an online survey. However, an online survey was much cheaper and less time consuming to do (p. 8). Online survey tended to have less completed surveys. Scott et al. (2011) argued that although the online survey method was the less responded method by participants, there was no proof that response bias and response rate could affect the overall results (p. 10).

5.7 Descriptive analysis

A descriptive analysis was performed on the data received. As mentioned in section 5.5, there were only 143 respondents who completed the survey, meaning that this survey research is not statistically significant. According to Creswell (2014), if the number of participants is not sufficient to be a statistical significance or is too small for advanced analysis, a descriptive analysis should be performed on the data retrieved.

The following sections provide a descriptive analysis and detail descriptions of dependent variables and independent variables using the Radar charts and Pie charts. The results of analysing the data received are presented as well.

5.7.1 Demographic distribution of participants

In this section, the age, gender, role, and platform used are considered as four demographic distributions of participants. These four distributions are considered as independent variables. The pie-charts of four distributions are provided in the following sections.

5.7.1.1 Distribution based on gender

The respondents had two options of gender to choose from male and female. There were 47 male respondents and 95 female respondents. One of the respondents did not answer the question.

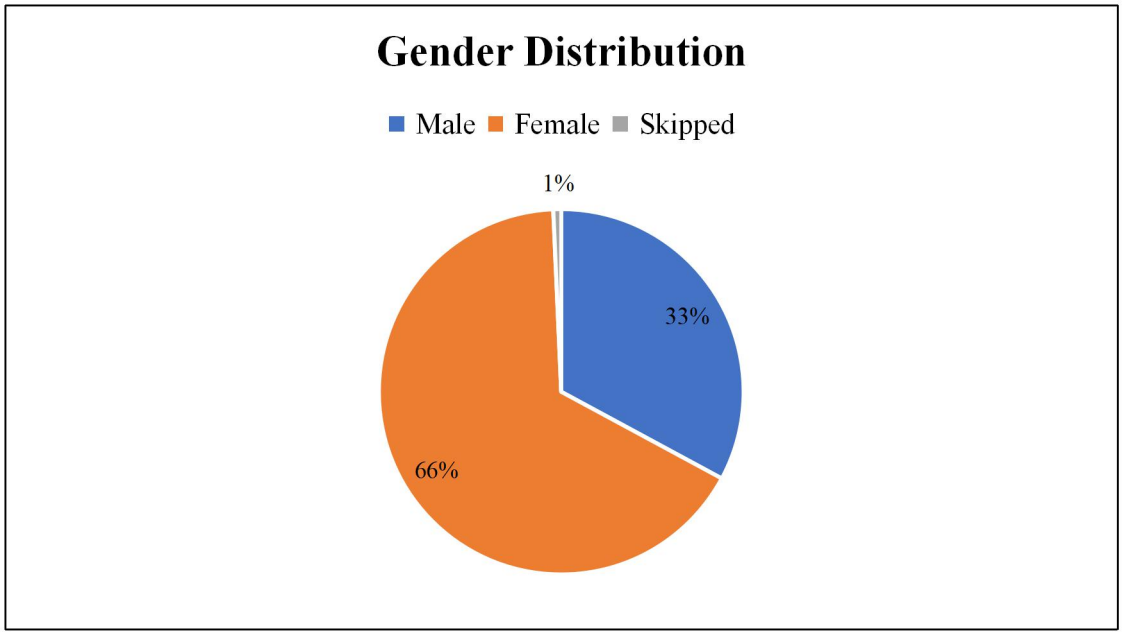

Figure 8. The pie-chart showing the gender distribution of the survey

Figure 8 shows the gender distribution of respondents. The highest distribution belonged to female respondents, with 66% of 143 respondents. The second highest was male respondents, with 33%. There was also one percent of a skipped or an unanswered respondent to Q1.

5.7.1.2 Distribution based on age

There were options of age groups provided to participants ranging from 18 - 24, 25 - 34, 35- 44, 45 - 54, 55 - 64, and 65+.

As illustrated in Figure 9, there were 64 participants whose age range was 18 – 24, 34 participants with age range of 24 – 34, 22 participants with age group of 35 - 44, 21 participants with age range of 45 – 54. There were no participants with an age range of 55 – 64. There was one participant with an age range of 65+ and one with skipped, respectively.

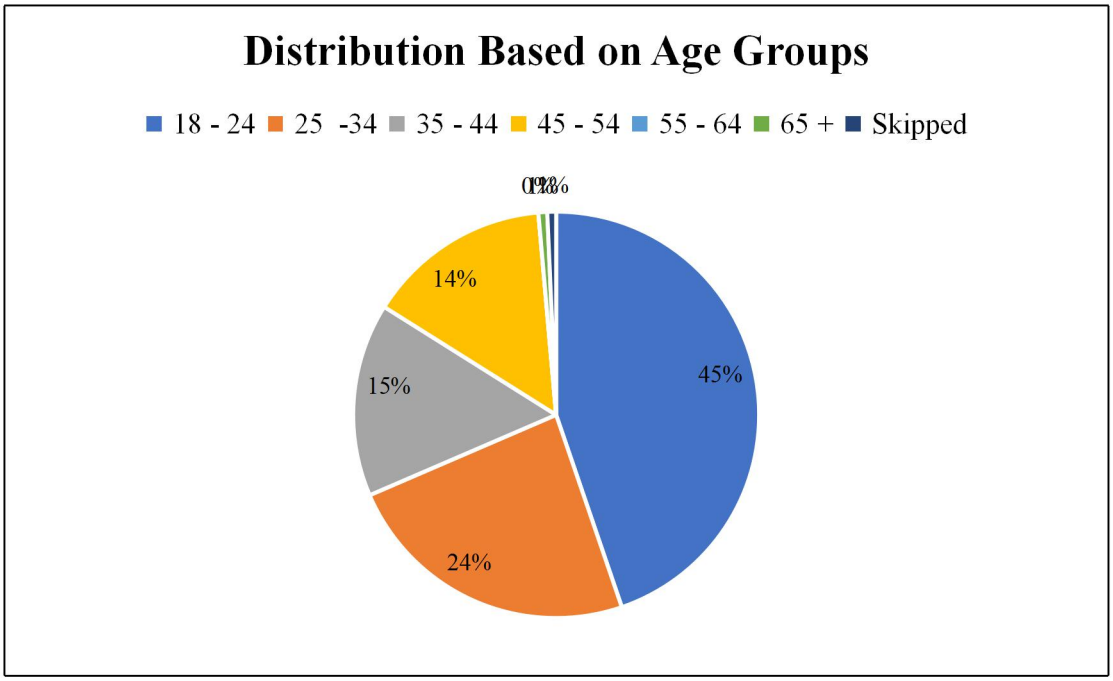

Figure 9. The pie-chart showing the distribution based on age groups

5.7.1.2.1 Distribution based on gender and age

As a majority of participants were female, gender differences should be taken into consideration. Fyhri, Johansson, and Bjornskau (2019) stated that gender differences should be considered as one of the key distributors when doing surveys (p. 2). As two-third of participants were female, splitting gender and age could show the exact demographic of participants.

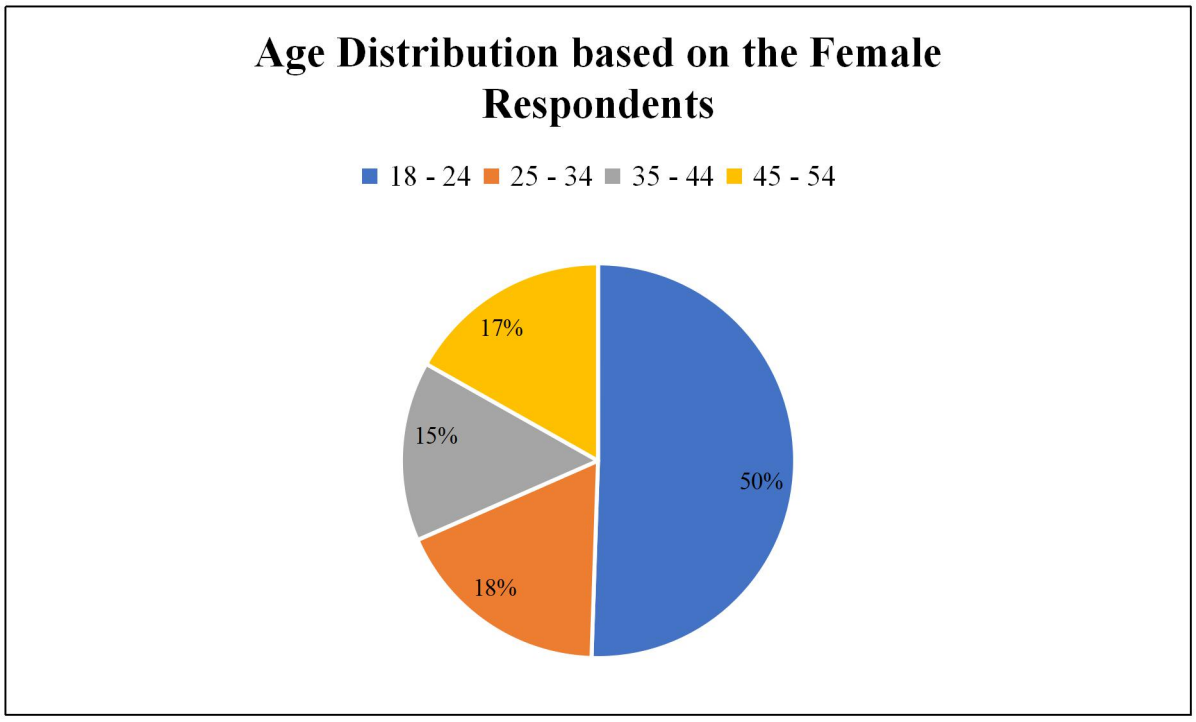

Figure 10. The pie-chart showing the age distribution of female respondents

As shown in Figure 10, there were 95 female respondents. 48 of them were age between 18 and 24, 17 of them were age between 24 and 34, 14 of them were age 35 and 44, and 16 of them were age between 45 and 54. There was no one older than 54.

As Figure 11 indicated, 50% of them were age between 18 and 24. This shows that young female respondents were the majority of the participants with other age groups

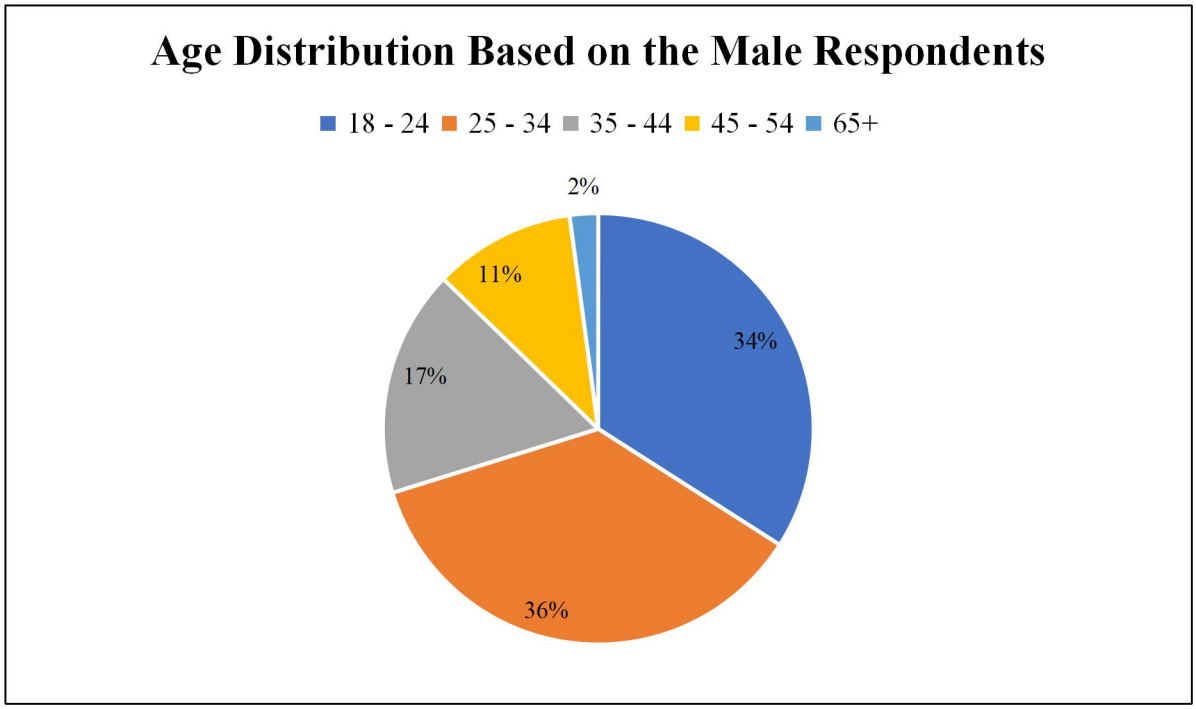

Figure 11. The pie-chart showing the age distribution of male respondents

distributed 18% (25 - 34), 15% (35 - 44), and 17% (45 – 54), respectively.

There were 47 male participants. Sixteen of them were age between 18 and 24, 17 of them were age between 25 and 34, 8 of them were age between 35 and 44, 5 of them were age between 45 and 54, and there was one 65 + participant. No respondent was age between 55 and 64. Only 34% of them were age 18 – 24 compared to female participants of 50% with the same age group (see Figure 10). 36% of them were age 25 – 34. 2% more than the age group of 18 – 24. 17% of them were age between 35 and 44. There was only 2% of 65+.

5.7.1.3 Distribution based on role

The role or the position of participants in education was collected. Collecting the role would give an idea of who the participants were and what their opinions were in a sense regarding AIED. As illustrated above, the majority of participants were between ages 18 and 34, with the female being more than male, meaning that this would affect the role distribution as a whole.

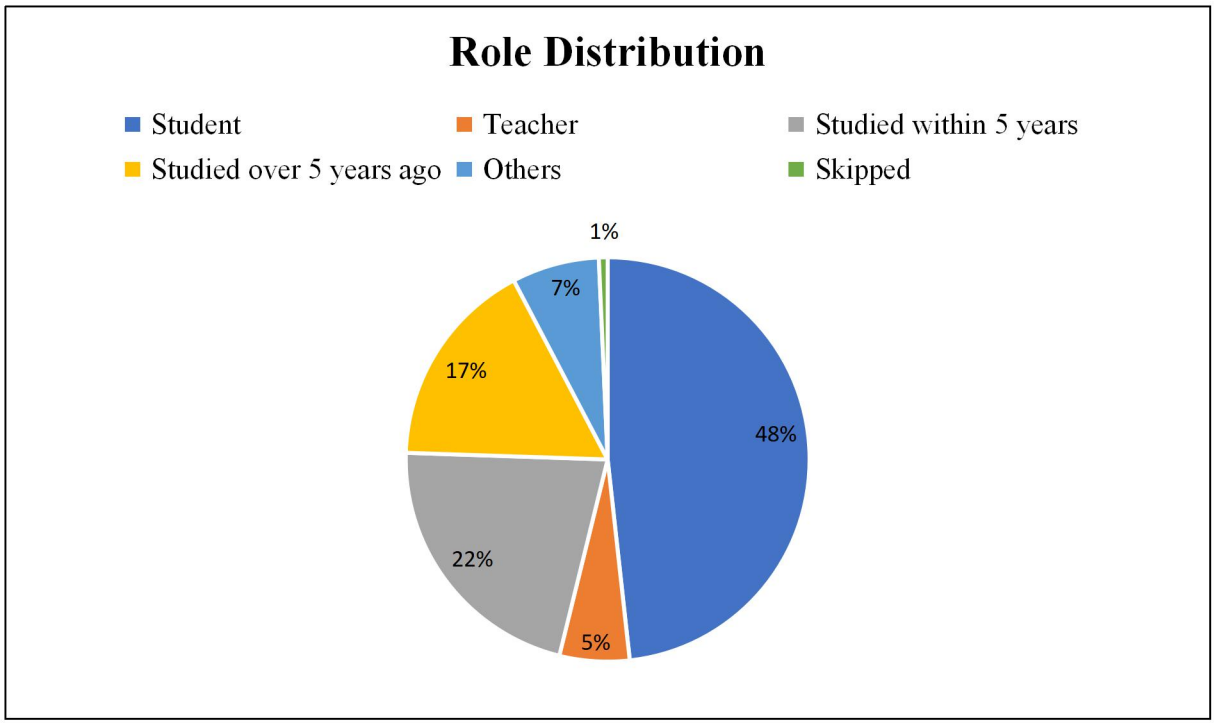

Figure 12. The pie-chart showing the role distribution of respondents

Figure 12 shows that 48% of participants were students, 5% were teachers, 22% were who studied within five years ago, 17% were who studied over five years ago, 7% chose others, and 1% skipped the question. As discussed above, most of the participants were between ages 18 and 34. There is no surprise that the Student category was the leading role. Since students were the main participants for this survey research, this survey research should reflect and represent the voice of students. The outcome of the data analysis should also provide an idea of what students think about using AI education and how they would respond to the new technologies.

5.7.1.4 Distribution based on platform (digital devices used for study)

Finding out what the types of devices students use to study would give an idea of which devices are the main preference for students. This will also provide important information on what platform or device format are the best places to start the integration of AI technologies. Figure 13 shows the participants' preferences regarding the devices they use.

Figure 13 shows that 52% of what they use is laptops. With desktops being the third

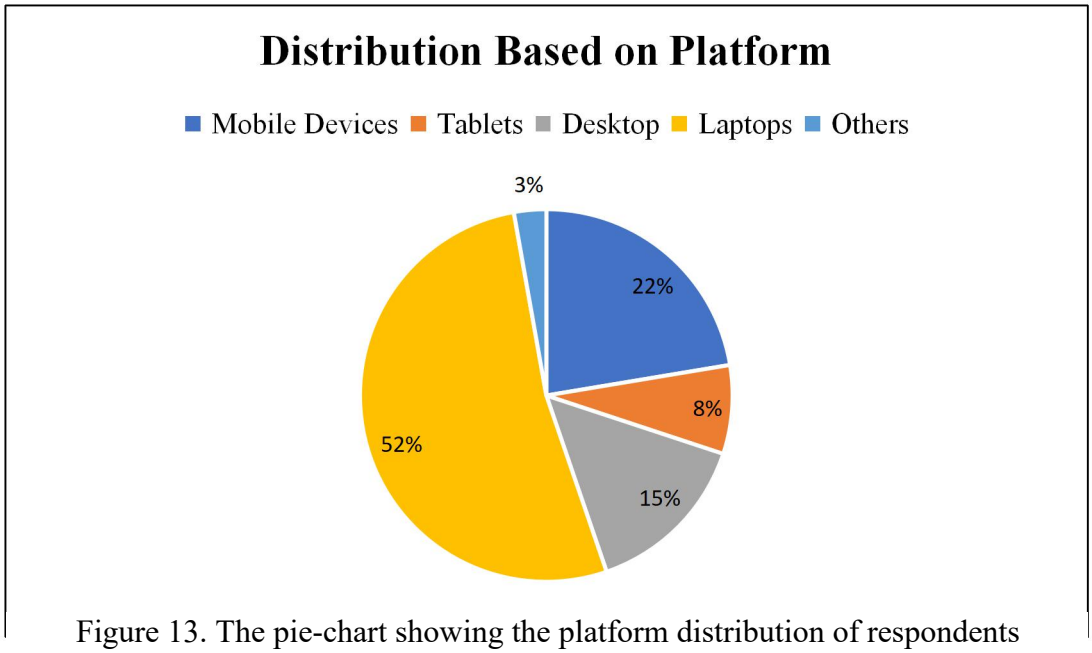

Figure 13. The pie-chart showing the platform distribution of respondents

most used platform, their preference was clear that they would use devices with usability leaning towards more powerful and easy for them to use. Laptops being lightweight and more comfortable to carry around, there is no surprise that students, who were the most participants, would use laptops over other devices as they would also offer more usability than mobile devices and tablets.

5.7.2 Respondents' answers for Q5 to Q13

The following sections provide a detailed analysis of respondents' answers from Q5 to Q13 based on the two demographics, gender, and age groups. Going through every question by gender and age groups may uncover a deeper understanding of the participants' views on AIED. Radar charts for Q5 to Q13 based on gender and age groups layout visual presentations of the answers from respondents. The creation of the user stories also gives an idea of what the participants think about AIED. Moreover, the outcome of analysing radar-charts may indicate that answers are affected by depending on what gender and the age group a respondent belongs to. Male and female respondents are split into two groups based on gender and also divided into groups based on the age group they belong to.

The perspectives of female and male respondents based on age groups (starting from age groups of 18 – 24 through to 65+) supply the necessary information needed to calculate Chi-Square (P-value). As suggested by Creswell (2014), "This analysis (a descriptive analysis) should indicate the means, standard deviations, and range of scores for these variables." The following list shows the list of the associations of the section numbers with the gender, age groups and Q5 to Q13;

5.7.2.1 Females' age group (18 – 24) and Q5 to Q13

5.7.2.2 Females' age group (25 – 34) and Q5 to Q13

5.7.2.3 Females' age group (35 – 44) and Q5 to Q13

5.7.2.4 Females' age group (45 – 54) and Q5 to Q13

5.7.2.5 Males' age group (18 – 24) and Q5 to Q13

5.7.2.6 Males' age group (25 – 34) and Q5 to Q13

5.7.2.7 Males' age group (35 – 44) and Q5 to Q13

5.7.2.8 Males' age group (45 – 54) and Q5 to Q13.

The sections are then broken down further into sections by one question at a time from Q5 to Q13 for each section.

5.7.2.1 Females' age group (18 – 24)

As found out in section 5.7.1.2.1, 50% of female respondents were age between 18 and 24. Since the category of female age between 18 and 24 was the most participated age group with the number of 48 participants, the responses from them played a significant role in this survey research. The data provided by them was valuable.

5.7.2.1.1 The radar-chart of the females' age group (18 – 24)

This section analyses the data received from the females' age group (18 – 24) for Q5 to Q13. For this section, a radar-chart is used to investigate the results. The following sub-sections discuss the results of Q5 to Q13.

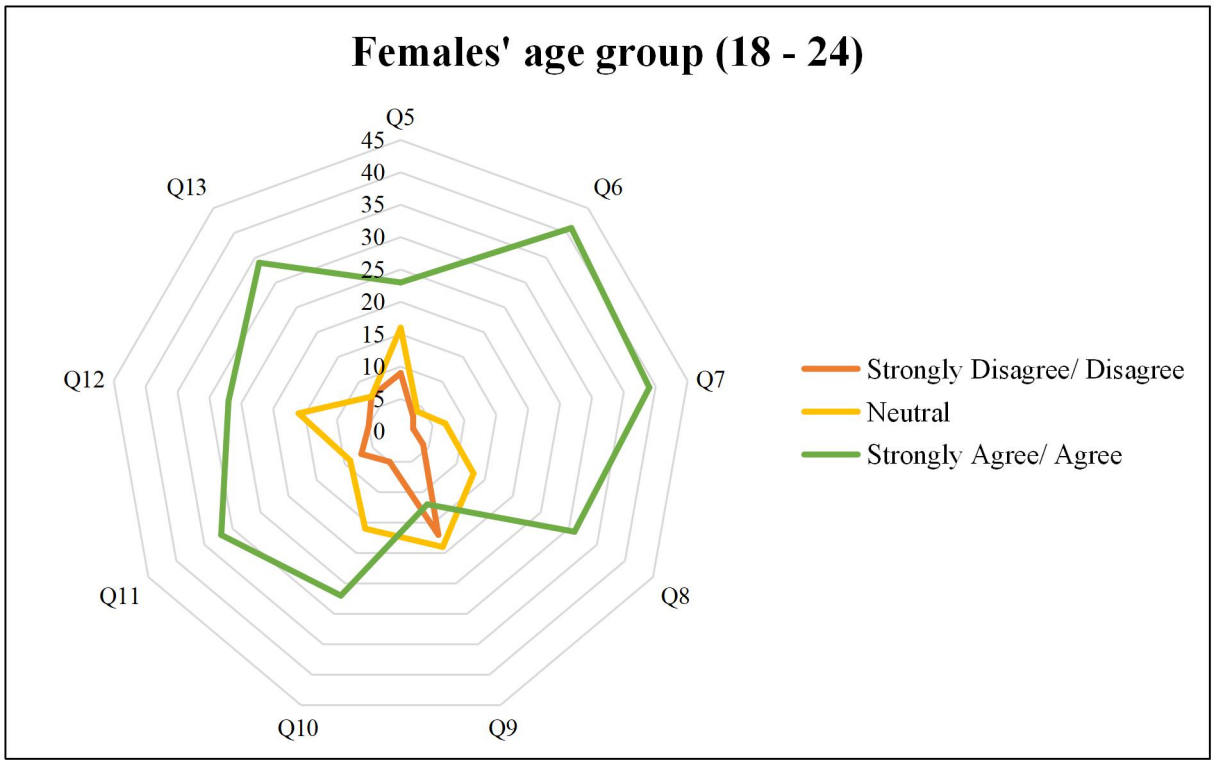

Figure 14. The radar-chart showing the association of the females' age group (18 - 24) and Q5 to Q13

Figure 14 shows the three variable values, Strongly Disagree (SD)/ Disagree (D), Neutral (N), and Strongly Agree (SA)/ Agree (A) in the radar chart with associated questions, Q5 to Q13.

5.7.2.1.1.1 The females' age group (18 – 24) and Q5

There are values associated with questions. For Q5, the value of SA/A is 23 out of 48 (see Figure 14), meaning that 47.92% of them agree that Q5, artificially intelligent performance tracking systems would improve students' performances. On the contrary, the value of SD/D of Q5 is 9 out of 48. 18.75% of them believed that the performance tracking systems would not make any difference to their performances. However, 16 of them could not decide and answer N to the Q5. The value of N (16) equals to 33.33% of the participants who answered Q5. By looking at the values and percentages for Q5, the assumption of artificial intelligent performance tracking systems would improve students' performances can be made.

5.7.2.1.1.2 The females' age group (18 – 24) and Q6

The value of SA/A for Q6 is 41 out of 48 (see Figure 14). 85.42% of the respondents who answered Q6 responded with SA/A, meaning that almost everyone apart from 3 participants, who answered SD/D and 4 participants who answered N to Q6, responded that having OLEs where students can modify to their needs would improve the performance of students. The participants who responded to SD/D and N to Q6 were 6.25% and 8.33%, respectively. As mentioned in section 3.3.2, an OLE where students can create their environments would allow them to perform better.

5.7.2.1.1.3 The females' age group (18 – 24) and Q7

Q7 was about RM that could provide the content or study materials to students by their preferences (see section 3.3.1.1). The value of 39 out of 48 responded SA/A to Q7 (see Figure 14). 81.25% of them agreed to the idea of using RM in education as RM could provide features that had abilities to support students with their preferred learning methods based on their learning styles. Seven participants (14.59%) chose N for Q7 as they could not decide whether they would use RM or not. Only two participants (4.17%) answered SD/D to Q7 as they felt that they would not like the implementation of RM in education.

5.7.2.1.1.4 The females' age group (18 – 24) and Q8

Q8 was included in the survey to ask participants whether they would use artificially intelligent tutors or not (see section 3.3.1). Referring to Figure 14, 31 out of 48 (64.58%) responded SA/A to Q8 as they would like to use AI tutors that could supply students with instant feedback. Thirteen of them selected N as an answer, which was 27.08% of 48 participants. The participants, who chose N, imply that they were hesitant to accept AI tutors as an educator. However, four people (8.33%) said no to AI tutors as they would not like using AI tutors in education.

5.7.2.1.1.5 The females' age group (18 – 24) and Q9

The values for Q9 are 17 SD/D, 19 N, 12 SA/A (see Figure 14). 35.42% of participants gave SD/D for Q9, which was a question about safety regarding the use of AI tracking systems in education. 39.58% answered N to Q9 as they were unsure about AI tracking systems operating in their online environments. 25% liked the idea of having AI tracking systems as the systems could provide the content based on their learning styles and online activities.

5.7.2.1.1.6 The females' age group (18 - 24) and Q10

Q10 was about using Chatbots in education. Looking at Figure 14, the value of SA/A is 27 out of 48. 56.25% of participants would use Chatbots that had abilities to communicate with students using NLG (see section 3.4.1). Although the majority of participants would use Chatbots, five participants would avoid using Chatbots, which were 10.41% of 48 respondents. However, 16 participants (33.33%) had answered N to Q10 as they thought Chatbots would not offer any benefits to their study.

5.7.2.1.1.7 The females' age group (18 – 24) and Q11

As Figure 14 shows, 32 respondents, which is 66.66% of 48 respondents, would use AI if AI technologies could prove that they had a positive effect on education. Nine participants, which was 18.75% of them, would not either use or ignore these technologies as they answered N to Q11. However, seven participants would not use AI as they did not believe that AI could be useful, which was 14.58% of 48 respondents.

5.7.2.1.1.8 The females' age group (18 – 24) and Q12

Q12 encompassed the entire survey questions by asking participants whether AI would provide a better learning experience for students or not. According to Figure 14, 27 (56.25%) of them believed that implementing these AI technologies would ensure that students would get a better learning experience. Although over half of the participants believed that AI would be suitable for education, 16 respondents (33.33%) of them were not sure about the ability of AI providing a better learning experience. Five of them answered SD/D to Q12 (10.41%), as they did not believe AI was a better option for them.

5.7.2.1.1.9 The females' age group (18 – 24) and Q13

Q13 was the last question of the survey and about whether participants would use AI technologies if they were available to them. 34 participants (70.83%) would use AI with seven participants (14.58%) who would not use AI by answering SD/D and seven of them (14.58%) who were not sure about using AI by answering N to Q13 according to Figure 14.

5.7.2.1.1.10 The results of the females' age group (18 – 24)

The following table (see Table 11) provides the results of the females' age group's (18 – 24) responses to Q5 – Q13 in percentage.

Table 11

The results of the Females' Age Group's (18 - 24) responses to Q5 - Q13

Questions	SD/D in percentage	N in percentage	SA/A in percentage
Q5	18.75%	33.33%	47.92%
Q6	6.25%	8.33%	85.42%
Q7	4.17%	14.59%	81.25%
Q8	8.33%	27.08%	64.58%
Q9	35.42%	39.58%	25%
Q10	10.41%	33.33%	56.25%
Q11	14.58%	18.75%	66.66%
Q12	10.41%	33.33%	56.25%
Q13	14.58%	14.58%	70.83%

The percentages with the most values are highlighted in red. The next section looks at the females' age group's (25 – 34) responses to Q5 – Q13.

5.7.2.2 Females' age group (25 – 34)

According to section 5.7.1.2.1, there were 17 female participants age between 25 and 34. The value of 17 covered 18% of female participants. Even though this age group was not the most participated, the significance of this group should be taken into considerations.

5.7.2.2.1 The radar-chart of the females' age group (25 – 34)

This section analyses the data gathered from the survey of the females' age group (25 – 34) for Q5 to Q13. The radar-chart provided below (see Figure 15) shows the results.

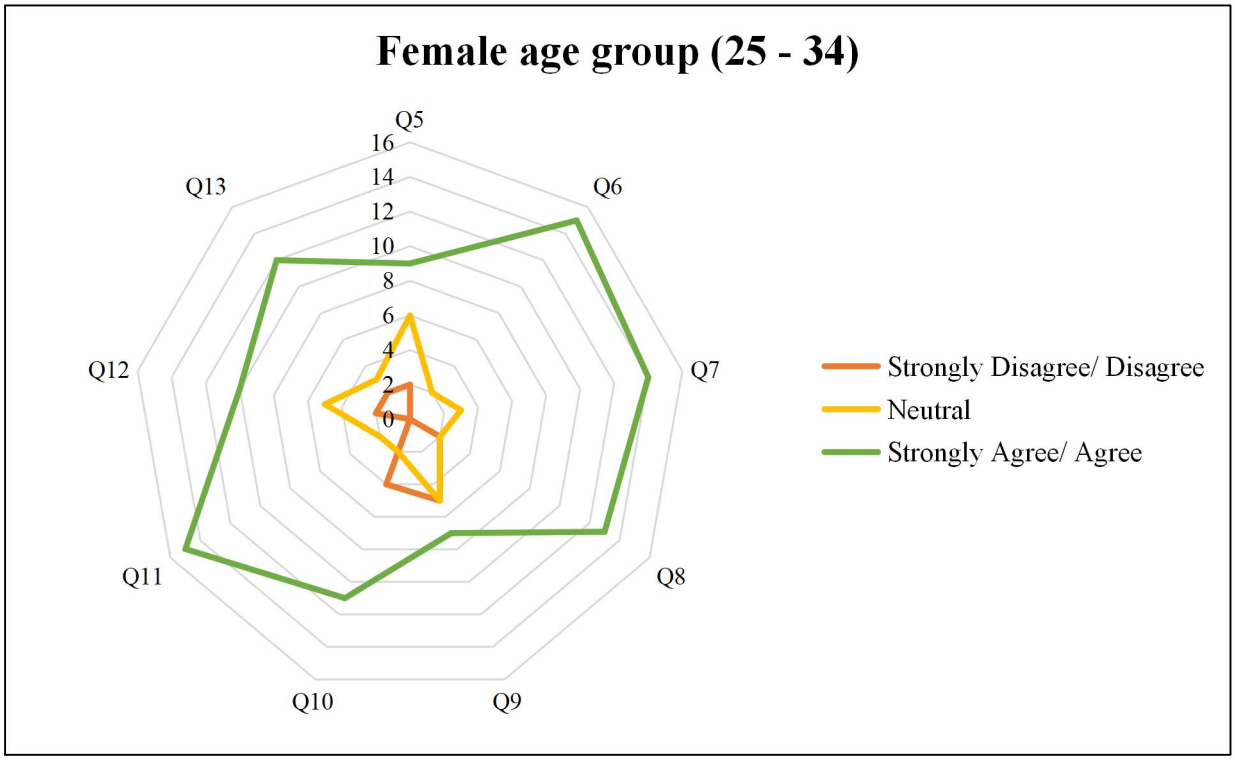

Figure 15. The radar-chart showing the association of the females' age group (25 - 34) and Q5 to Q13

Figure 15 shows the three variable values, Strongly Disagree (SD)/ Disagree (D), Neutral (N), and Strongly Agree (SA)/ Agree (A) in the radar chart with associated questions, Q5 to Q13. The following sub-sections discuss the outcome of this radar-chart.

5.7.2.2.1.1 The females' age group (25 – 34) and Q5

According to Figure 15, the value of SA/A for Q5 is nine out of 17. The value showed that over half of participants (52.94%) were keen on using AI tracking systems in education as they thought that tracking systems would improve students' performance. Although over half of them agreed to use AI tracking systems, 11.76% or the value of two out of 17 disagreed with the idea of using AI tracking systems. However, 35.29% of respondents with the value of six stated that they would not rule out or would welcome the usage of AI tracking systems in education as they answered N to Q5.

5.7.2.2.1.2 The females' age group (25 – 34) and Q6

As illustrated in Figure 15, there were no participants who answered SD/D to Q6. 88.24% or the value of 15 participants answered SA/A to Q6. Apart from two participants (11.76%) who chose N for Q6, everyone would like to have an OLE with an ability to modify to their needs. They believed that having such an environment would improve their performances as well.

5.7.2.2.1.3 The females' age group (25 – 34) and Q7

The demonstration of Figure 15 implied that no participant disagreed or would not use RM in education. 14 out of 17 or 82.35% of participants indicated that they would use RM by answering SA/A to Q7. Only 3 participants or 17.65% of them would think about using RM as they chose N for Q7.

5.7.2.2.1.4 The females' age group (25 – 34) and Q8

Figure 15 indicated that there were 13 participants out of 17 (76.47%) who thought that AI tutors would be a great addition to education as they answered SA/A to Q8. Two of four participants (11. 76%) chose SD/D, and the other two (11.76%) answered N to Q7. They concluded that using AI tutors would affect education.

5.7.2.2.1.5 The females' age group (25 – 34) and Q9

As Figure 15 pointed out, seven (41.18%) out of 17 participants would feel safe with AI tracking systems being in their online environments. However, five out of 17 (29.41%) participants disagreed with the fact that AI tracking systems were operating in their online environments. Also, five participants (29.41%) of them had no interest nor had issues with AI tracking systems.

5.7.2.2.1.6 The females' age group (25 – 34) and Q10

Referring to Figure 15 points out that eleven out of 17 respondents (64.71%) answered SA/A and indicated that they would use Chatbots if they were proven to be able to communicate by using NLG (see section 3.4.1). Although over half of the participants who answered for this question would use Chatbots, 23.53% or four participants would not use Chatbots as they disagreed with the Q10. Out of 17, two of them had no intention of using Chatbots and also did not mind with the implementation of Chatbots in education as they chose to answer N to Q10.

5.7.2.2.1.7 The females' age group (25 – 34) and Q11

With Figure 15 in mind, the statistics showed that 15 (88.24%) out of 17 participants would use AI as long as AI was proven to be effective. Two participants were unsure of using AIED as they selected N for Q11 with a percentage of 11.76%. No participant disagreed with the plan of using AIED.

5.7.2.2.1.8 The females' age group (25 – 34) and Q12

As Figure 15 indicated, ten participants (58.82%) considered that using AI technologies would improve students' performance. On the contrary, two participants (11.76%) assumed that AI technologies would not be useful as they chose to answer SD/D to Q12. Although two of them believed AI would not be good for education, five (29.41%) out of 17 participants could not conclude as they provided with the answer of N to Q12.

5.7.2.2.1.9 The females' age group (25 – 34) and Q13

Q13 was the conclusion of the survey as participants had to answer whether they would use these technologies if they were available to them. Out of 17, twelve of them said they would use AI technologies, which was 70.59% of participants who answered Q13. However, two participants (11.76%) would not use AI technologies as they thought that these technologies were not created with the student-centred approach. Three participants (17.65%), on the other hand, were not convinced that these technologies could offer any benefits to them. Still, they would not mind the implementations of these technologies as they answered N to Q13.

5.7.2.2.1.10 The results of the females' age group (25 – 34)

This section presents the results of the females' age group (25 – 34) for Q5 to Q13 using a table (see Table 12).

Table 12

The Results of the Females' Age Groups' (25 -34) responses to Q5 - Q13

Questions	SD/D in percentage	N in percentage	SA/A in percentage
Q5	11.76%	35.29%	52.94%
Q6	0%	11.76%	88.24%
Q7	0%	17.65%	82.35%
Q8	11.76%	11.76%	76.47%
Q9	29.41%	29.41%	41.18%
Q10	23.53%	11.76%	64.71%
Q11	0%	11.76%	88.24%
Q12	11.76%	29.41%	58.82%
Q13	11.76%	17.65%	70.59%

The percentages with the most values are highlighted in red to differentiate the results. The next section analyses the females' age group (35 – 44).

5.7.2.3 Females' age group (35 – 44)

Fourteen female participants were aged between 35 and 44, according to section (5.7.1.2.1). Out of 95 female respondents, only 14 participants or 15% of them were in this age group (35 – 44), as suggested by Figure 10. Although this group only accounted for 15% of the entire female respondents, the importance of these participants' opinions should not be ignored.

5.7.2.3.1 The radar-chart of the females' age group (35 – 44)

This section analyses the relationship between the females' age group (35 – 44) and their responses to Q5 – Q13 by using the radar-chart. Three variable values were used, SD/D, N, and SA/A with associated questions, Q5 to Q13. The following subsections further break down the results of the radar-chart.

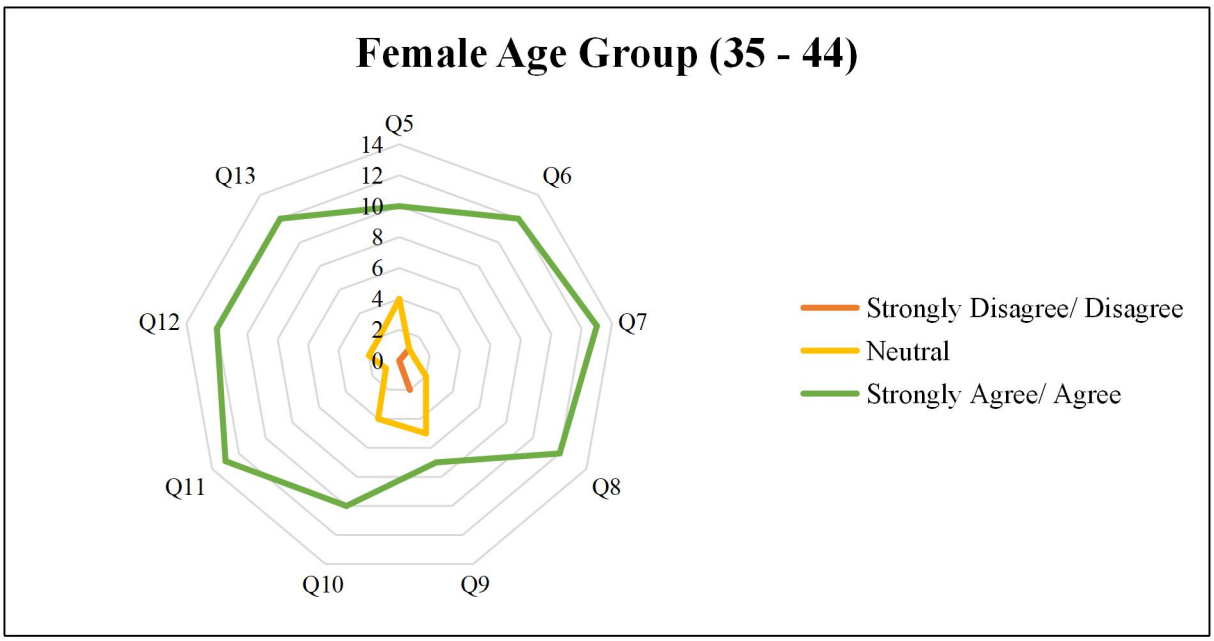

Figure 16. The radar-chart showing the association of the females' age group (35 - 44) and Q5 to Q13

Figure 16 shows the results of the answers and the values associated with that particular question. The radar-chart also outlines the general perspectives of the females' age group (35 – 44) on AIED.

5.7.2.3.1.1 The females' age group (35 – 44) and Q5

As seen in Figure 16, there were ten participants out of 14 (71.43%) who thought that employing AI tracking systems would improve the overall performance of students. No participant thought otherwise as no one answered SD/D to Q5. However, four participants or 28.57% were not able to decide whether they would use AI tracking systems or not as they selected N.

5.7.2.3.1.2 The females' age group (35 – 44) and Q6

Looking at Figure 16 showed that out of 14 participants, one (7.14%) chose to disagree with the idea of OLEs that allowed students to modify as they pleased would elevate the standard of their performances. On the other side, 12 participants (85.71%) trusted that OLEs with an ability to allow students to make changes would raise the achievements of students. Only one (7.14%) was not convinced with the suggestion of using OLEs in education and answered N to Q6.

5.7.2.3.1.3 The females' age group (35 – 44) and Q7

Q7 was about using RM in education. 13 (92.86%) out of 14 participants would like to use RM in education as they chose the variable value of SA/A. One participant (7.14%) would not use RM and answered N to Q7. However, no one refused to use RM in education, according to Figure 16.

5.7.2.3.1.4 The females' age group (35 – 44) and Q8

The data in Figure 16 for Q8 showed that 12 participants (85.71%) agreed to use AI tutors in education as AI tutors could offer a shorter processing time when examining students. Not everyone was satisfied with the idea of using AI tutors as two of the participants out of 14 (14.29%) were sceptical about having AI tutors as they answered N to Q8.

5.7.2.3.1.5 The females' age group (35 – 44) and Q9

As depicted in Figure 16, seven participants (50%) would feel safe by having AI tracking systems in their online environments. Five out of 14 respondents (35.71%) were not keen on using tracking systems. However, they also did not deny to use the systems as they selected N for Q9. The remaining two participants (14.29%) were not interested in using AI tracking systems. Therefore, they disagreed with Q9.

5.7.2.3.1.6 The females' age group (35 – 44) and Q10

Figure 16 suggested that Q10 had no participant with the answer of SD/D. Ten participants (71.43%) pointed out that they would agree to the plan of employing Chatbots in education. The other four participants (28.57%) had no desire to utilise the use of Chatbots as they chose N for Q10.

5.7.2.3.1.7 The females' age group (35 – 44) and Q11

Figure 16 illustrated that 92.86% or 13 out of 14 respondents would like to use AI if AI could support and help them to get better performances. The idea of implementing AI did not excite one participant (7.14%) who replied N to Q11.

5.7.2.3.1.8 The females' age group (35 – 44) and Q12

The facts in Figure 16 showed that no one thought that AI applications would not play a part in elevating performances of students. 12 (85.71%) out of 14 participants believed that AI would improve the performances of students. Two participants (14.29%), however, was unsure about AI being able to provide an excellent platform for students as they answered N to Q12.

5.7.2.3.1.9 The females' age group (35 – 44) and Q13

Referring to Figure 16, the shape of the radar-chart indicated that there were 12 participants (85.71%) who would use AI applications if they were available to them. However, two participants (14.29%) suggested that they would not be against the idea of using these applications. However, they also would not use these technologies as they answered N to Q13.

5.7.2.3.1.10 The results of the females' age group (35 – 44)

The table (see Table 13) provided in this section displays the results of the females' age group (35 – 44) for Q5 to Q13.

Table 13

The Results of the Females' Age Groups' (35 - 44) responses to Q5 - Q13

Questions	SD/D in percentage	N in percentage	SA/A in percentage
Q5	0%	28.57%	71.43%
Q6	7.14%	7.14%	85.71%
Q7	0%	7.14%	92.86%
Q8	0%	14.29%	85.71%
Q9	14.29%	35.71%	50%
Q10	0%	28.57%	71.43%
Q11	0%	7.14%	92.86%
Q12	0%	14.29%	85.71%
Q13	0%	14.29%	85.71%

The values with the most percentages are highlighted in red. The next section analyses the responses of the females' age group (45 – 54) for Q5 to Q13.

5.7.2.4 Females' age group (45 – 54)

Sixteen participants or 17% out of 95 participants were the females with the age group of 45 to 54, according to section 5.7.1.2.1. This group placed third out of four groups, as seen in Figure 10. Even if this group was not the most participated age group, the viewpoints of these respondents should be given attention.

5.7.2.4.1 The radar-chart of the females' age group (45 – 54)

This section includes the analysis of the responses of the females' age group 45 to 54 for Q5 to Q13. The radar-chart provided below investigates the data retrieved from the survey and presents the results.

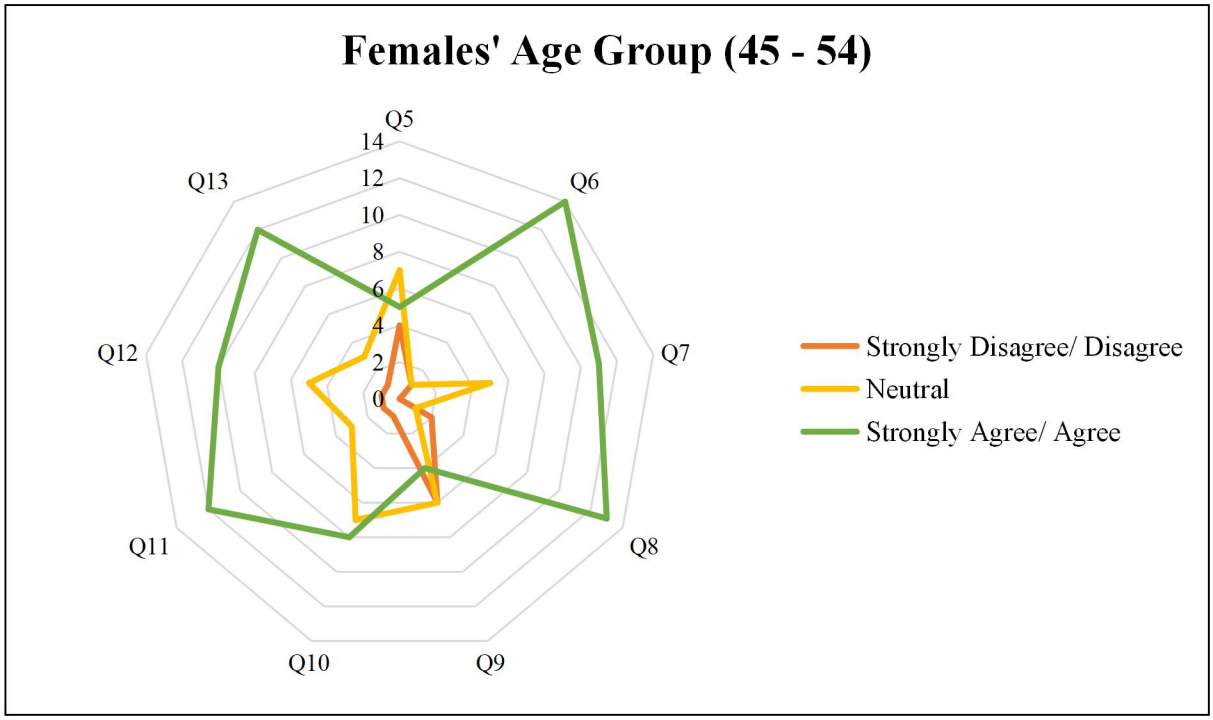

Figure 17. The radar-chart showing the association of females' age group (45 - 54) and Q5 to Q13

Figure 17 represents the values associated with the questions and also shows the three options of answers in the form of SD/D, N, and SA/A. The following nine subsections are the detailed analysis of each question and its values.

5.7.2.4.1.1 The females' age group (45 – 54) and Q5

Out of three possible answers, seven (43.75%) out of 16 participants chose N as an answer, indicating that they would stay neutral about using AI tracking systems in education. However, four participants (25%) were against using AI tracking systems as they disagreed with Q5. Five participants (31.25%), on the other hand, would like to see the implementation of AI tracking systems in education, according to Figure 17.

5.7.2.4.1.2 The females' age group (45 – 54) and Q6

Q6 was about using OLEs. Fourteen respondents (87.50%) chose SA/A and were willing to use OLEs, according to Figure 17. Only one participant (6.25%) indicated that using OLEs would not improve the performances of students. The remaining one participant (6.25%) answered N to Q6, meaning that OLEs may or may not improve performances.

5.7.2.4.1.3 The association between the females' age group (45 – 54) and Q7

No participant disagreed with using RM in education, as shown in Figure 17. Eleven participants (68.75%) would want to see RM being employed in education as they answered SA/A. Five participants (31.25%) answered N to Q7 as they were not sure about using RM in education.

5.7.2.4.1.4 The females' age group (45 – 54) and Q8

Out of 16 participants, 13 (81.25%) expressed that they would like to have AI tutors that could give feedback instantly by answering SA/A. Only one participant (6.25%) decided to provide N for Q8, according to Figure 17. The other two participants (12.5%), however, did not like the suggestion of implementing AI tutors in education as they disagreed with Q8.

5.7.2.4.1.5 The females' age group (45 – 54) and Q9

Q9 was about the safety of students regarding AI tracking systems. Six participants (37.50%) concerned about their safety and did not want AI tracking systems in education as they chose SD/D for Q9. The same number of participants, six (37.50%), answered N for Q9 as they were not sure about using AI tracking systems. However, four participants (25%) would like to have AI tracking systems in education, as depicted in Figure 17.

5.7.2.4.1.6 The females' age group (45 – 54) and Q10

Eight (50%) out of 16 participants would want to see the implementation of Chatbots in education by agreeing to Q10. Although Chatbots proved to be one of the most anticipated technologies, according to Brandtzaeg and Følstad (2018), seven respondents (43.75%) were anxious about using Chatbots, as indicated in Figure 17. One participant (6.25%) did not want to see Chatbots being implemented in education by disagreeing with Q10.

5.7.2.4.1.7 The females' age group (45 – 54) and Q11

The values from Figure 17 showed that 12 participants (75%) would like to use AI if AI applications were tested and guaranteed to have a positive effect on education. 18.75% or three participants could not determine whether they would use AI applications or not as they chose to answer N to Q11. Regardless of whether AI has a positive effect or not, one participant (6.25%) would not use AI by answering SD/D to Q11.

5.7.2.4.1.8 The females' age group (45 – 54) and Q12

According to Figure 17, ten (62.5%) out of 16 participants answered SA/A and believed that AI applications would provide a better learning experience for students. Five participants (31.25%) had different opinions and were not sure AI could do such things as they answered N to Q12. Only one participant (6.25%) disagreed with the fact that AI technologies would be so useful.

5.7.2.4.1.9 The females' age group (45 – 54) and Q13

The statistics of Figure 17 showed that 12 participants (75%) would use AI technologies if they were available to them. Three participants (18.75%) were not sure that they would use AI applications as they answered N to Q13. Only one participant (6.25%) would not use AI technologies by answering SD/D to Q13.

5.7.2.4.1.10 The results of the females' age group (45 – 54)

The following table (see Table 14) presents the results of the females' age group (45 – 54) for Q5 to Q13.

Table 14

The Results of the Females' Age Groups' (45 - 54) responses to Q5 - Q13

Questions	SD/D in percentage	N in percentage	SA/A in percentage
Q5	25%	43.75%	31.25%
Q6	6.25%	6.25%	87.50%
Q7	0%	31.25%	68.75%
Q8	12.50%	6.25%	81.25%
Q9	37.50%	37.50%	25%
Q10	6.25%	43.75%	50%
Q11	6.25%	18.75%	75%
Q12	6.25%	31.25%	62.5%
Q13	6.25%	18.75%	75%

The numbers with red highlight have a bigger percentage than the others. The next section looks at the analysis of the males' age group (18 – 24).

5.7.2.5 Males' age group (18 – 24)

As Figure 8 suggested, 33% or 47 participants were male, or a third of the entire respondents (143) belonged to the male gender group. Out of 47 male participants, 16 of them were aged between 18 and 24, which was 34% of the entire male respondents, according to Figure 11.

5.7.2.5.1 The radar-chart of the males' age group (18 – 24)

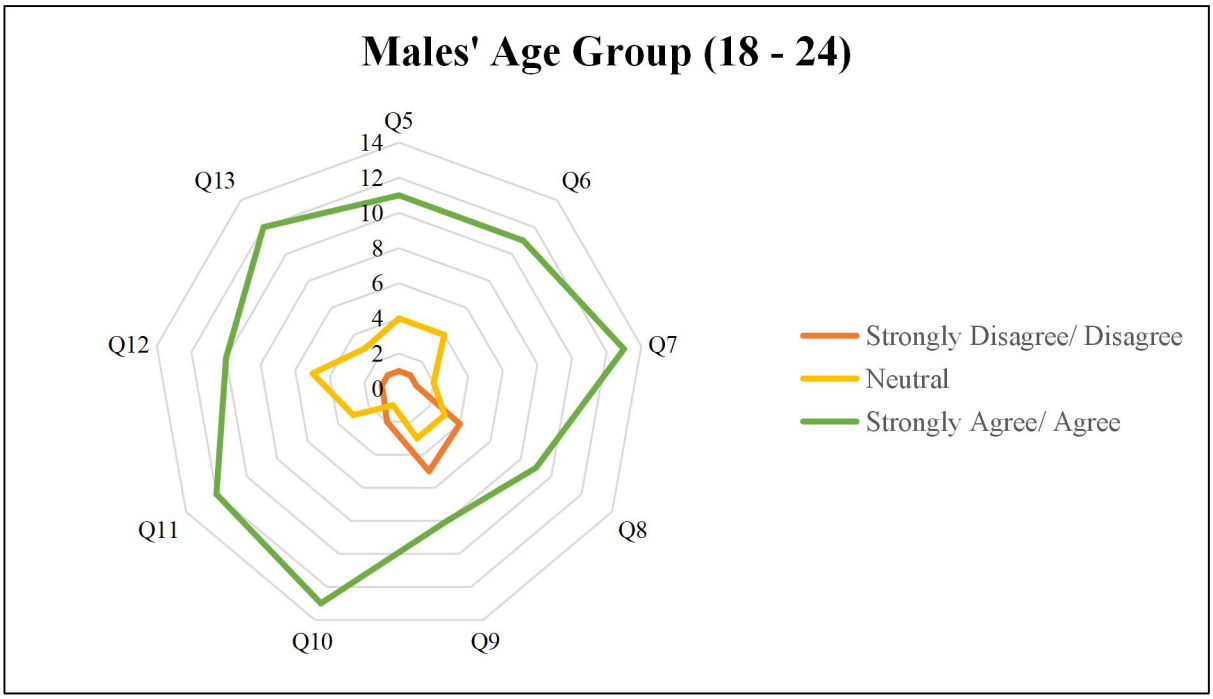

Figure 18. The radar-chart showing the association of male age group (18 - 24) and Q5 to Q13

This section analyses and uses the radar-chart to investigate the relationship between the males' age group (18 – 24) and their answers for Q5 to Q13. Three variable values, SD/D, N, and SA/A, are used to analyses the answers.

Figure 18 shows the questions associated with the responses of the male age group (18 – 24) using a colour-coded system. The following subsections analyse and discuss the outcome of Figure 18.

5.7.2.5.1.1 The males' age group (18 – 24) and Q5

Eleven or 68.75% out of 16 participants agreed that having AI performance tracking systems would improve the performance of students. One participant (6.25%), however, chose the opposite answer and would not like to have AI performance tracking systems, as seen in Figure 18. The other four participants (25%) selected N as an answer indicating that they would not like to use AI tracking systems; neither would be against the implementation of such technologies.

5.7.2.5.1.2 The males' age group (18 – 24) and Q6

Referring to Figure 18 revealed that 11 participants (68.75%) intended to use LMSs that let students modify to their likings as they responded SA/A to Q6. Not all who answered Q6 had the same viewpoint as the others, which was why four participants (25%) chose N as an answer as they did not think LMSs would bring up performances of students to higher standards or they did not believe LMSs would affect students' performances. One participant (6.25%) disagreed that LMSs would make any differences to the performances of students and answered SD/D.

5.7.2.5.1.3 The males' age group (18 – 24) and Q7

The value or the number of participants who answered SA/A to Q7 was 13 (81.25%), as illustrated in Figure 18. The 13 participants agreed that they would like to have an RM in education. Although the majority of the participants in this age group agreed to use RM, one participant (6.25%) thought that RM would not make any positive addition to the education system and answered SD/D. Two other participants (12.5%) were not confident that RM could be useful as they answered N to Q7.

5.7.2.5.1.4 The males' age group (18 – 24) and Q8

Nine (56.25%) out of 16 participants expressed their interested in AI tutors that could give feedback to students in a shorter time frame by answering SA/A to Q8. However, four participants (25%) who disagreed with using AI tutors answered SD/D according to Figure 18. On the other hand, three participants (18.75%) could not decide whether AI tutors were a good idea or not as they picked N as the answer for Q8.

5.7.2.5.1.5 The males' age group (18 – 24) and Q9

Q9 asked participants whether they would feel safe using AI tracking systems or not. Eight (50%) out of 16 participants showed that they had no issues with the AI tracking system being in their online environments. Five participants (31.25%) did not agree with the idea of implementing AI tracking systems in education as they selected an answer of SD/D. Three participants (18.75%) did not entirely trust AI tracking systems and also did not mention that they would ignore the use of AI tracking systems as they opted to answer N to Q9, as depicted in Figure 18.

5.7.2.5.1.6 The males' age group (18 – 24) and Q10

Looking at Figure 18 pointed out that SA/A was the most answered option out of three. Thirteen participants (81.25%) answered SA/A for Q10 as they would like to use Chatbots that could communicate using NLG. Two (12.5%) out of 16 participants did not have any intentions to use Chatbots as they disagreed with Q10. One participant (6.25%) was not convinced that Chatbots using NLG to communicate with students would have any impact on education and answered N for Q10.

5.7.2.5.1.7 The males' age group (18 – 24) and Q11

As shown in Figure 18, there were 12 participants (75%) who would use AI technologies if they were proven to have a positive impact. Three participants (18.75%) were not sure about using such technologies as they answered N to Q11. Out of 16 participants, only one participant (6.25%) did not like having AI technologies in education, therefore answered SD/D.

5.7.2.5.1.8 The males' age group (18 – 24) and Q12

Ten participants (62.5%) said that AI applications would provide a better learning experience for students. On the other hand, one respondent (6.25%) believed that these technologies would not make any difference to the experience and disagreed with Q12. Five participants (31.25%), however, did not make their minds up as they answered N, as seen in Figure 18.

5.7.2.5.1.9 The males' age group (18 – 24) and Q13

Q13 asked if participants would use AI technologies if they had access to them. Thirteen (81.25%) out of 16 participants would like to use AI technologies if they had a chance. Only one participant (6.25%) would ignore the technologies, therefore selected SD/D as an answer. As shown in Figure 18, two participants (12.5%) did not mind having these technologies available to them, but they did not specify that they would use them as they pick N as an answer for Q13.

5.7.2.5.1.10 The results of the males' age group (18 – 24)

This section consists of the table (see Table 15) with the results of the males' age group (18 – 24) for Q5 to Q13.

Table 15

The Results of the Males' Age Group's (18 - 24) responses for Q5 - Q13

Questions	SD/D in percentage	N in percentage	SA/A in percentage
Q5	6.25%	25%	68.75%
Q6	6.25%	25%	68.75%
Q7	6.25%	12.5%	81.25%
Q8	25%	18.75%	56.25%
Q9	31.25%	18.75%	50%
Q10	12.5%	6.25%	81.25%
Q11	6.25%	18.75%	75%
Q12	6.25%	31.25%	62.5%
Q13	6.25%	12.5%	81.25%

The values with red highlights represent the most significant percentages out of the three values. The next section looks at the analysis of the males' age group (25 – 34) for Q5 to Q13.

5.7.2.6 Males' age group (25 – 34)

There were 17 participants with the gender male and the age group (25- 34), which was 36% of the male respondents, according to Figure 11. 36% was more than 34%, which was the male age group (18 – 24). This group was the most participated age group for males.

5.7.2.6.1 The radar-chart of the males' age group (25 – 34)

This section analyses the results of the male age group (25 – 34) and puts it into a radar-chart. The association between their answers and Q5 to Q13 was also presented in the radar-chart provided below (see Figure 19). There were three variable values, SD/D, N, and SA/A, assigned to Q5 – Q13.

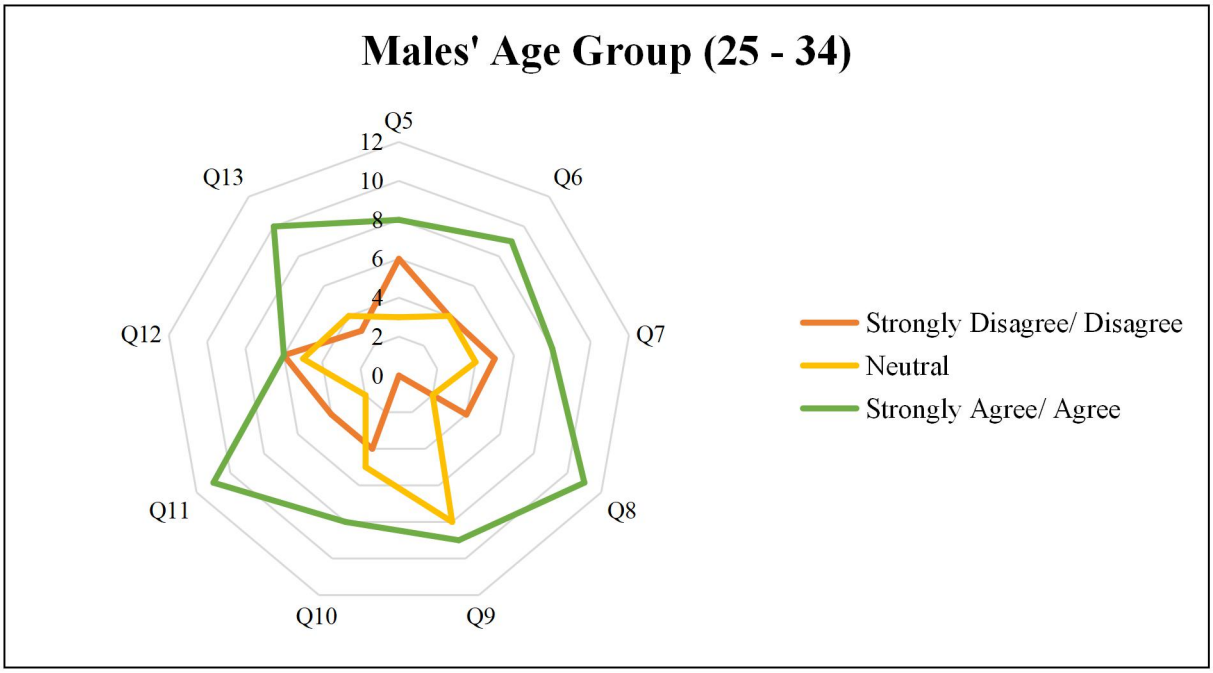

Figure 19. The radar-chart showing the association of male age group (25 - 34) and Q5 to Q13

Figure 19 shows the questions and their corresponding answers. The colour-coded system is used for this radar-chart to avoid any confusion. The following subsections discuss the results of each question, Q5 to Q13.

5.7.2.6.1.1. The males' age group (25 – 34) and Q5

As illustrated in Figure 19, eight (47.1%) out of 17 participants agreed that using AI tracking systems would improve the performance of students by answering SA/A. Six participants (32.3%) did not think that AI tracking systems would be useful; therefore, they answered SD/D. Three participants (17.65%) believed that the tracking systems would not make any difference to education as they answered N to Q5.

5.7.2.6.1.2 The males' age group (25 – 34) and Q6

Nine (52.94%) out of 17 respondents believed that having a modifiable online learning environment would improve the performance of students; therefore, answered SD/D. According to Figure 19, four participants (23.53%), on the other hand, thought that employing such a learning environment would not make anything better as they answered N to Q6. The other four participants (23.53%) disagreed with the above nine participants and selected SD/D as they did not think the online environment would not improve students' performances.

5.7.2.6.1.3 The males' age group (25 – 34) and Q7

As shown in Figure 19, there were eight participants (47.1%) who had an opinion of using RM in education as they chose SA/A as an answer. Five participants (29.41%) would not use RM as they did not see it fit for purpose. Therefore, they disagreed with implementing RM in education. Four participants (23.53%) could not make their minds up as they answered N for Q7.

5.7.2.6.1.4 The males' age group (25 – 34) and Q8

Eleven participants (64.71%) agreed to the idea of using AI tutors as they believed that AI tutors could offer instant feedback. Four (23.53%) out of 17 participants, however, were not interested in using AI tutors, thus answered SD/D for Q8, as shown in Figure 19. Only two participants (11.76%) could not make their minds up as they answered N to Q8.

5.7.2.6.1.5 The males' age group (25 – 34) and Q9

No one disagreed with using AI tracking systems in education in this age group, as stated in Figure 19. Nine (52.94%) out of 17 participants expressed that they would use AI tracking systems. Although over half of this male age group said they would use AI tracking systems, eight participants (47.01%) were not sure about implementing AI tracking systems in education as they answered N to Q9.

5.7.2.6.1.6 The males' age group (25 – 34) and Q10

Out of 17 participants, eight participants (47.01%) would use Chatbots that could communicate with them. Four participants (23.53%) did not have any intention of using Chatbots in education as they answered SD/D to Q10, according to Figure 19. Five participants (29.41%) did not have any idea about using Chatbots in education; therefore, they answered N to Q10.

5.7.2.6.1.7 The males' age group (25 – 34) and Q11

Eleven participants (64.71%) would use AI applications if they had a positive effect on education. Four participants (23.53%) did not want to use AI applications even if they were proven to be effective, according to Figure 19. Two participants, however, did not have a clear answer to Q11, thus answered N to Q11.

5.7.2.6.1.8 The males' age group (25 – 34) and Q12

Six respondents (35.30%) thought that AI applications or technologies would provide a better learning experience for students. Exactly six respondents (35.30%) thought otherwise as they answered SD/D to Q12. Five participants (29.41%), on the other hand, could not choose either SA/A or SD/D and answered N to Q12, as depicted in Figure 19.

5.7.2.6.1.9 The males' age group (25 – 34) and Q13

As shown in Figure 19, ten participants (58.82%) would use AI technologies defined in section 3.3, thus answered SA/A to Q13. Three participants (17.65%) denied to use these technologies and choose SD/D. Four participants (23.53%) were unsure what to do regarding AI technologies as they answered N to Q13.

5.7.2.6.1.10 The results of the males' age group (25 – 34)

This section represents the results of the males' age group's (25 – 34) responses for Q5 to Q13 using a table (see Table 16).

Table 16

The Results of the Males' Age Group's (25 - 34) responses for Q5 - Q13

Questions	SD/D in percentage	N in percentage	SA/A in percentage
Q5	31.3%	17.65%	47.1%
Q6	23.53%	23.53%	52.94%
Q7	29.41%	23.53%	47.1%
Q8	23.53%	11.76%	64.71%
Q9	0%	47.01%	52.94%
Q10	23.53%	29.41%	47.01%
Q11	23.53%	11.76%	64.71%
Q12	35.30%	29.41%	35.30%
Q13	17.65%	23.53%	58.82%

The red percentages are the most values out of three and indicate the differences between them. The next section analyses the data gathered from the males' age group (35 – 44) for Q5 to Q13.

5.7.2.7 Males' age group (35 – 44)

Figure 11 showed that there were only eight participants (17%) in this age group out of 47 male respondents. Even though this group was not the most participated compared to others, the opinions of these respondents would be considered as important as the other groups.

5.7.2.7.1 The radar-chart of the males' age group (35 – 44)

This section analyses the data retrieved from the males' age group (35 – 44). The data is presented using radar-chart. The values associated with the questions and three variable values are displayed in the chart provided below (see Figure 20).

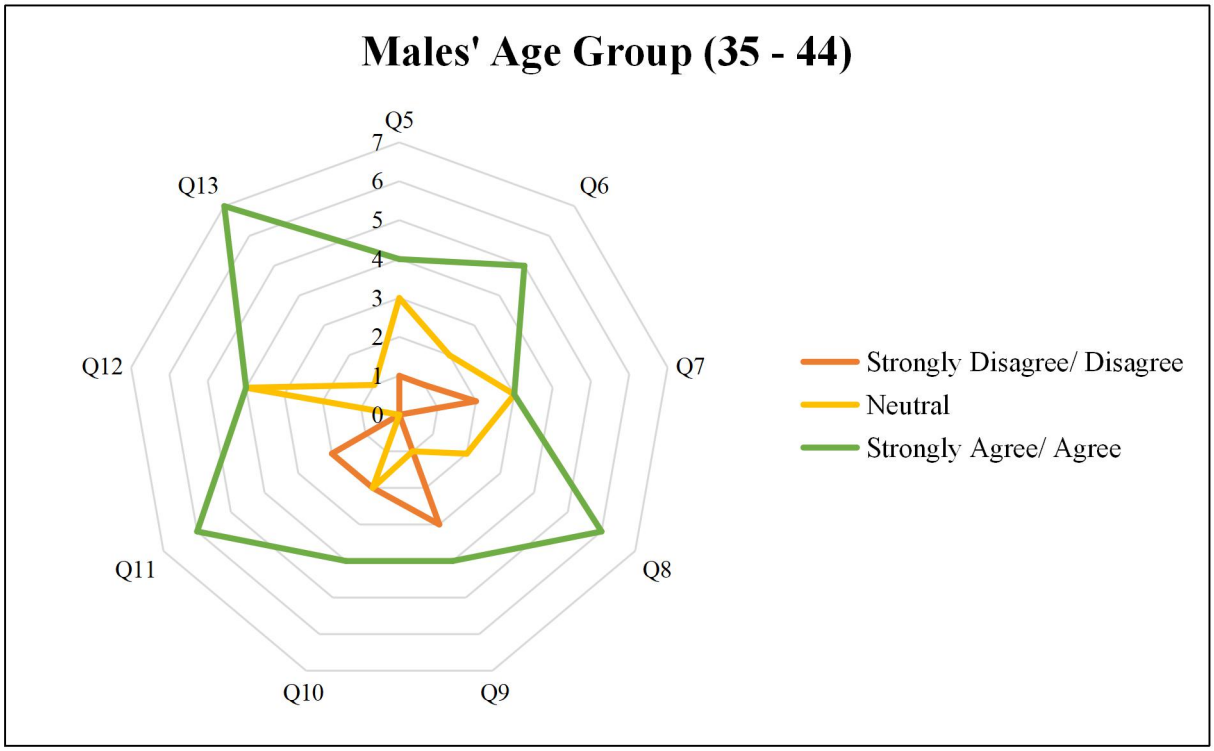

Figure 20. The radar-chart showing the association between the males' age group (35 - 44) and Q5 to Q13

Figure 20 shows the three variables values (SA/A, N, and SD/D) and their corresponding questions with the colour-coded system. The following sections discuss the questions and their values from the radar-chart.

5.7.2.7.1.1 The males' age group (35 – 44) and Q5

Out of eight participants, four participants (50%) agreed that using AI tracking systems would improve the students' performances. Only one participant (12.5%) had a different view than the four participants stated above and did not think the AI tracking system would do anything for students; therefore, he answered SD/D to Q5 according to Figure 20. Three participants (37.5%) did not have a decisive opinion on the Q5, thus answered N.

5.7.2.7.1.2 The males' age group (35 – 44) and Q6

As shown in Figure 20, five participants (62.5%) thought that having an online environment that allowed students to have the freedom to modify their likings would increase the performance of students. One participant (12.5%), however, did not agree to the idea of such an online environment and answered SD/D for Q6. Two participants (25%) did not give a decisive answer and chose N for Q6.

5.7.2.7.1.3 The males' age group (35 – 44) and Q7

Three (37.5%) out of eight participants liked the idea of using RMs in educations as RMs could give suggestions of students' preferred content. Two participants (25%) did not think RMs could do as promised as they disagreed with using RMs, according to Figure 20. The other three participants (37.5%) gave an undecided answer (N) to Q7.

5.7.2.7.1.4 The males' age group (35 – 44) and Q8

No one disagreed with using AI tutors in this group, as shown in Figure 20. Six participants (75%) indicated that they would use AI tutors that could offer instant feedback or a short time of processing for assessments or tests. Two participants (25%), on the other hand, did not have a conclusive answer to Q8, therefore, answered N.

5.7.2.7.1.5 The males' age group (35 – 44) and Q9

Four participants (50%) would not mind having AI tracking systems in their online environment. However, three participants (37.5%) would not feel safe if AI tracking systems were running in their online environment. One participant was not sure whether to use AI tracking systems or not, thus answered N to Q9, according to Figure 20.

5.7.2.7.1.6 The males' age group (35 – 44) and Q10

Q10 was about Chatbots. Four (50%) out of eight participants would like having Chatbots in education. Two participants (25%), however, did not want Chatbots as they thought that Chatbots would not bring anything new to their study and answered SD/D to Q10. The other two participants (25%) would not agree using Chatbots but also would not have any issues with Chatbots; thus, they answered N to Q10 according to Figure 20.

5.7.2.7.1.7 The males' age group (35 – 44) and Q11

No participant answered N for Q11. Only two participants (25%) expressed that they would not use AI applications even if AI applications had evidence of having a positive effect on education. Six participants (75%) indicated that they would use AI technologies if they could help them and had proven to be useful as they answered SA/A to Q11, according to Figure 20.

5.7.2.7.1.8 The males' age group (35 – 44) and Q12

Four participants (50%) believed that AI technologies would provide a better learning experience if they were used as intended. The other four participants (50%) were not convinced that AI technologies would affect learning experience as they answered N to Q12, according to Figure 20.

5.7.2.7.1.9 The males' age group (35 – 44) and Q13

Out of eight participants, seven of them (87.5%) would use AI technologies if they were available to them. Only one participant (12.5%) hesitated to use AI technologies, thus answered N to Q13, as depicted in Figure 20. No one indicated that they would not use these technologies (see section 3.3).

5.7.2.7.1.10 The results of the males' age group (35 – 44)

The table (see Table 17) presented in this section displays the results of the males' age group (35 - 44) for Q5 to Q13.

Table 17

The Results of the Males' Age Group's (35 - 44) responses for Q5 - Q13

Questions	SD/D in percentage	N in percentage	SA/A in percentage
Q5	12.5%	37.5%	50%
Q6	12.5%	24%	62.5%
Q7	25%	37.5%	37.5%
Q8	0%	25%	75%
Q9	37.5%	12.5%	50%
Q10	25%	25%	50%
Q11	25%	0%	75%
Q12	0%	50%	50%
Q13	0%	12.5%	87.5%

Table 17 presents the percentages of the males' age group (35 – 44) with the red highlight showing the most significant percentages. The next section analyses the data of the males' age group (45 – 54) for Q5 to Q13.

5.7.2.8 Males' age group (45 – 54)

Figure 11 indicated that only five participants were age between 45 and 54 with male gender, which accounted for 11% of the entire male respondents' population. This group was the second least participated group, with 11% out of 47 respondents.

5.7.2.8.1 The radar-chart of the males' age group (45 – 54)

This section looks at the data gathered from the males' ager group (45 – 54) and analyses the data using a radar-chart. The values associated with questions are displayed in the radar-chart provided below (see Figure 21).

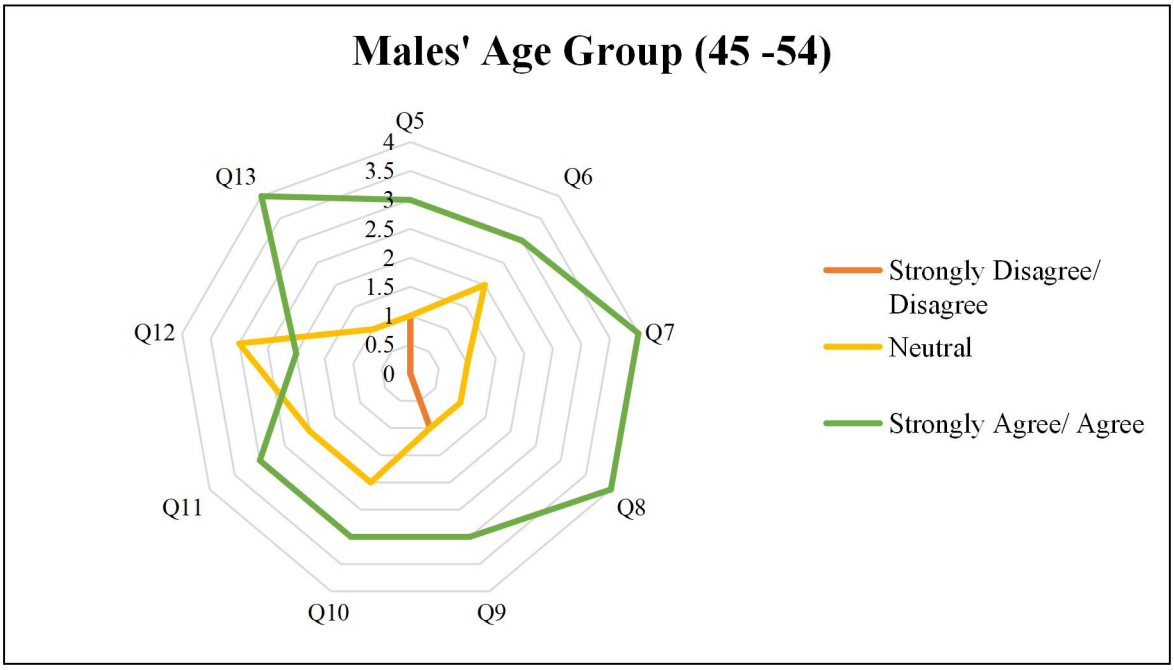

Figure 21. The radar-chart show the association between the males' age group (45 - 54) and Q5 to Q13

Figure 21 shows the three variable values associated with questions. A colour-coded system is used to point out the difference between SA/A, N, and SD/D. The following sections discuss the detailed analysis of each question of this group.

5.7.2.8.1.1 The males' age group (45 – 54) and Q5

Three (60%) out of five participants believed that using AI tracking systems would improve students' performances. One participant (20%) was not entirely sure as to whether AI tracking systems would do anything for education, thus answered N for Q5. The last participant (20%), however, disagreed that AI tracking systems would have any impact on education and answered SD/D, according to Figure 21.

5.7.2.8.1.2 The males' age group (45 – 54) and Q6

No one disagreed with the idea of using OLEs that allow students to make changes according to their needs. Three participants (60%) would use OLEs as they indicated by answering SA/A for Q6. Two participants (40%) did not have a clear answer for Q6, according to Figure 21, as they answered N.

5.7.2.8.1.3 The males' age group (45 – 54) and Q7

As the same as Q6, no one selected SD/D for Q7. Four participants (80%) out of five would use RMs in education. One participant (20%), however, had a troubled mind regarding using RMs in school; therefore, he answered N for Q7 as depicted in Figure 21.

5.7.2.8.1.4 The males' age group (45 – 54) and Q8

For Q8, also no one disagreed with using AI tutors that could give feedback to students within a short time frame. Four participants (80%) indicated that they would like to use AI tutors, as shown in Figure 21. Only one participant (20%) chose N as an answer, meaning that not everyone was keen on using AI tutors.

5.7.2.8.1.5 The males' age group (45 – 54) and Q9

One participant (20%) believed that using AI tracking systems in education would not be safe for students. Another one participant (20%) was not sure about having AI tracking systems in their online environments; thus, he answered N for Q9. As shown in Figure 21, three participants (60%) would feel safe using AI tracking systems.

5.7.2.8.1.6 The males' age group (45 – 54) and Q10

No one indicated that they would not use Chatbots that could have a conversation using NLG (see section 3.4.1). Three participants (60%) would use Chatbots in education as they agreed that Chatbots would help them when they had questions to ask. Two (40%) out of five respondents did not have a clear decision about Chatbots; therefore, they answered N for Q10 according to Figure 21.

5.7.2.8.1.7 The males' age group (45 – 54) and Q11

Three participants (60%) would use AI applications or technologies if AI had a positive impact on education. Two other participants (40%) were not convinced that AI would have such an impact on education as they answered N to Q11, as illustrated in Figure 21. Nobody disagreed with the idea of using AI in education, as there was no SD/D answer.

5.7.2.8.1.8 The males' age group (45 – 54) and Q12

Three participants (60%) had a mixed feeling about AI providing a better learning experience for students; thus, answered N for Q12. Two participants (40%), on the other hand, believed that AI would provide a better learning experience for students. No one thought otherwise, as no one disagreed with Q12, as shown in Figure 21.

5.7.2.8.1.9 The males' age group (45 – 54) and Q13

Four people (80%) out of five, who participated in this survey with the age group of 45 to 54, expressed that they would use the AI technologies discussed in section 3 if they were available to them. One participant (20%) was not entirely satisfied and answered N for Q13, as suggested by Figure 21.

5.7.2.8.1.10 The results of the males' age group (45 – 54)

This section presents the table (see Table 18), providing the results of the males' age group (45 – 54) for Q5 to Q13.

Table 18

The Results of the Males' Age Group's (45 - 54) responses for Q5 - Q13

Questions	SD/D in percentage	N in percentage	SA/A in percentage
Q5	20%	20%	60%
Q6	0%	40%	60%
Q7	0%	20%	80%
Q8	0%	20%	80%
Q9	20%	20%	60%
Q10	0%	40%	60%
Q11	0%	40%	60%
Q12	0%	60%	40%
Q13	0%	20%	80%

Table 18 provides the results in the percentages. The red numbers represent the most significant percentages amongst the other values. The next section discusses the males' age group (65+).

5.7.2.9 Males' age group (65+)

There was one male participant with the age group of 65+. The data retrieved from this participant was provided in a table format rather than a radar-chart in a below section (see section 5.7.2.9.1).

5.7.2.9.1 The males' age group (65+) and Q5 to Q13

The following table shows the answers collected from the males' age group (65+). The numbering or coding system described in Table 6 is used.

Table 19

The Responses of the Males' Age Group (65+) to Q5 - Q13

Questions	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**
Responses	2	2	1	2	1	2	1	2	2

This participant answered N for Q5, N for Q6, SA/A for Q7, N for Q8, SA/A for Q9, N for Q10, SA/A for Q11, N for Q12, and N for Q13 according to Table 19.

5.8 Univariate Analysis of Variance (ANOVA)

This section discusses why the univariate analysis is used for this research. According to Creswell (2014), if there are two or more independent variables with one dependent variable without any control variables, ANOVA should be used with the normal distribution scores. With the confidence of the level of 95% (see section 4.8), the significance level of the P-value derived from Chi-square is set at 0.05. The p-value is to measure the strength of statistical evidence or data in this case (Ware, Mosteller, Delgado, Donnelly, & Ingelfinger, 1992, p. 181). Meaning that if the calculated P-value of the dependent variables is less than 0.05, the evidence or data can be determined as significant or strong, indicating that the relationship between the independent and dependent variables is significant. On the other hand, if the calculated P-value is more than 0.05, the relationship between the independent and dependent variables is not significant, or there is no relationship between the two variables. First, P-values are calculated based on the assumptions that the null is true for the population and that the difference in the sample is caused entirely by random chance. Consequently, P-values can't tell researchers the probability that the null is true or false because it is 100% true from the perspective of the calculations. As the P-values is lower than 0.05, it can be considered as a null hypothesis as the data provides enough evidence.

5.8.1 P-value, the variables, and the questions

This section discussed the consideration of the P-values, the independent variables, dependent variables, and the related questions. As shown in Table 4, there are three dependent variables, Tracking Systems, AI Technologies or Applications, and the Expectations of AI. These three dependent variables are to be tested against the two independent variables, gender, and age groups. There are two questions related to the dependent variable (Tracking Systems), Q5 and Q9. The dependent variable (AI Technologies) includes four questions, Q6, Q7, Q8, and Q10. The dependent variable (The expectations of AI) consists of three questions, Q11, Q12, and Q13.

For each of the independent variable groups (gender and age groups), a cross-tabulation is performed between an independent variable group (i.e., female with age group (18 – 24)) and the dependent variable (e.g., Tracking Systems) to calculate the P-value. The process of finding P-value for the two genders (Female and Male) with age groups (18 – 24, 25 – 34, 35 – 44, 44 – 54, and 65+) is performed for each of the dependent variables.

5.8.2 The Process of P-value Calculation

For calculation of the P-value, the mean or average of the actual value of Q5 and Q9 is calculated first. After the calculation of the mean, there is a function called CHITEST (the actual range, the expected range) in the Excel application that can automatically calculate the P-value. The five-point scales of Q5 and Q9 are used (see section 5.4.3) to calculate the P-value. The following table (see Table 20) shows an example of how the P-value is calculated using the data set of Q5 and Q9 of the females' age group (18 – 24).

Table 20

The P-value of the Females' Age Group (18 - 24) for the Tracking Systems

The variable values	**The actual value of Q5**	**The actual value of Q9**	**The expected value or the mean of Q5**	**The expected value or the mean of Q9**
SD	3	5	9.6	9.6
D	6	12	9.6	9.6
N	16	19	9.6	9.6
A	20	10	9.6	9.6
SA	3	2	9.6	9.6
			P-value	**0.0000000064157**

Table 20 shows the actual and expected value of Q5 and Q9, as well as the P-value, returned by the Excel application. The P-value of the females' age group is really small, meaning that there is 0.0000000064157 chance of null hypothesis not being true. Although this is a strong or small P-value, this may affect the validity of findings.

5.8.3 P-value and the tracking systems

The following subsections analyse the correlation between the gender and age groups with the tracking systems and calculate the P-value of the dependent variable (Tracking Systems). The P-value of the following calculation indicates whether the gender and age groups have connections or relationships with the use of tracking systems. If the P-value is above 0.05, the results can be considered as not significance, meaning that there is no relationship between the gender and age group with the tracking systems. However, if the P-value is smaller than 0.05, the results or outcome can be considered as significance, indicating that there is a relationship between the gender and age groups with the tracking system.

The actual and expected value of Q5 and Q9 for each gender with each age group are also included in the following subsections.

5.8.3.1 Tracking systems and the female's age groups

The following subsections analyse the association between the females' age groups and the tracking systems. The calculations of P-value and the data are presented in table format.

5.8.3.1.1 Tracking systems and the females' age group (18 – 24)

This subsection looks at the association between the tracking systems and the females' age group (18 – 24) in a table format and the calculation of the P-value. The table for this calculation is provided in section 5.8.2 (see Table 20). The P-value for this group is 0. 0000000064157.

5.8.3.1.2 Tracking systems and the females' age group (25 – 34)

This subsection analyses the association between the tracking systems and the females' age group (18 – 24) in a table format and calculates the P-value.

Table 21

The P-value of the Females' Age Group (25 - 34) for the Tracking Systems

The variable values	The actual value of Q5	The actual value of Q9	The expected value or the mean of Q5	The expected value or the mean of Q9
SD	1	1	3.4	3.4
D	1	4	3.4	3.4
N	6	5	3.4	3.4
A	9	5	3.4	3.4
SA	0	2	3.4	3.4
			P-value	**0.000211522**

Table 21 provides the actual and expected value of Q5 and Q9 and the P-value for the females' age group (25 – 34). The P-value for this group is 0.000211522.

5.8.3.1.3 Tracking systems and the females' age group (35 – 44)

The following table (see Table 22) shows the association between the tracking systems and the females' age group (35 – 44) in a table format. The P-value is also displayed.

Table 22

The P-value of the Females' Age Group (35 - 44) for the Tracking Systems

The variable values	The actual value of Q5	The actual value of Q9	The expected value or the mean of Q5	The expected value or the mean of Q9
SD	0	0	2.8	2.8
D	0	2	2.8	2.8
N	4	5	2.8	2.8
A	8	7	2.8	2.8
SA	2	0	2.8	2.8
			P-value	**0.00000523336**

Table 22 shows the P-value, the actual and expected value of the females' age group (35 – 44). The P-value of this group is 0.00000523336.

5.8.3.1.4 Tracking systems and the females' age group (45 – 54)

This subsection provides the table (see Table 23) of the association between the tracking systems and the females' age group (45 – 54) and the P-value.

Table 23

The P-value of the Females' Age Group (45 - 54) for the Tracking Systems

The variable values	The actual value of Q5	The actual value of Q9	The expected value or the mean of Q5	The expected value or the mean of Q9
SD	2	2	3.2	3.2
D	2	4	3.2	3.2
N	7	6	3.2	3.2
A	5	4	3.2	3.2
SA	0	0	3.2	3.2
			P-value	**0.002855938**

Table 23 displays the actual and expected value of Q5 and Q9 and the P-value of 0.002855938.

5.8.3.1.5 P-values of the females' age groups

The following table (see Table 24) reveals the relationship between the females' age group and the tracking systems using P-value. The green values indicate that they are below the standard value of 0.05.

Table 24

The P-value of the Females' Age Groups for the Tracking Systems

Table No.	Table Title or Description	P-value
Table 20	The P-value of the Females' Age Group (18 - 24)	0.0000000064157
Table 21	The P-value of the Females' Age Group (25 - 34)	0.000211522
Table 22	The P-value of the Females' Age Group (35 - 44)	0.00000523336
Table 23	The P-value of the Females' Age Group (45 - 54)	0.002855938

As seen in Table 24, the P-values of the female's age groups are below or less than 0.05, indicating that females are significant with all the age groups and the tracking systems.

5.8.3.2 Tracking systems and the males' age groups

The following subsections provide a detailed analysis of the association between the males' age groups and the tracking systems. The calculations of P-value and the data are presented in a table format.

5.8.3.2.1 Tracking systems and the males' age group (18 – 24)

This subsection analyses the data provided by the males' age group (18 – 24). The association between the tracking systems and the male's age group (18 – 24) is shown in the table provided below (see Table 25) using the P-value.

Table 25

The P-value of the Males' Age Group (18 - 24) for the Tracking Systems

The variable values	The actual value of Q5	The actual value of Q9	The expected value or the mean of Q5	The expected value or the mean of Q9
SD	0	0	3.2	3.2
D	1	5	3.2	3.2
N	4	3	3.2	3.2
A	9	5	3.2	3.2
SA	2	3	3.2	3.2
			P-value	**0.0002991**

Table 25 provides the P-value of the males' age group (18 – 24) on the tracking systems using the actual and the expected value. The P-value of this group is 0.0002991, which is below the value of 0.05.

5.8.3.2.2 Tracking systems and the males' age group (25 – 34)

The following table (see Table 26) in this section provides the analysis of the association between the tracking systems and the males' age group (25 – 34). The table also provides the P-value.

Table 26

The P-value of the Males' Age Group (25 – 34) for the Tracking Systems

The variable values	The actual value of Q5	The actual value of Q9	The expected value or the mean of Q5	The expected value or the mean of Q9
SD	1	0	3.4	3.4
D	5	0	3.4	3.4
N	3	8	3.4	3.4
A	6	6	3.4	3.4
SA	2	3	3.4	3.4
			P-value	**0.000473388**

Table 26 shows the actual and expected value of Q5 and Q9 for the males' age group along with the P-value of 0.000473388 for the association between the males' age group (25 – 34) and the tracking systems.

5.8.3.2.3 Tracking systems and the males' age group (35 – 44)

This subsection consists of the table (see Table 27) that includes the data from the males' age group (35 – 44) in the form of five-point scales and the actual and expected value of this age group as well as the P-value.

Table 27

The P-value of the Males' Age Group (35 – 44) for the Tracking Systems

The variable values	The actual value of Q5	The actual value of Q9	The expected value or the mean of Q5	The expected value or the mean of Q9
SD	0	2	1.6	1.6
D	1	1	1.6	1.6
N	3	1	1.6	1.6
A	4	4	1.6	1.6
SA	0	0	1.6	1.6
			P-value	**0.007295**

As depicted in Table 27, the P-value of the males' age group (35 – 44) is 0.007295, which is smaller than or below the value of 0.05.

5.8.3.2.4 Tracking systems and the males' age group (45 – 54)

This subsection provides the analysis of the relationship between males' age group (45 – 54) and the tracking systems using the P-value. The following table (see Table 28) includes the actual and expected value as well as the P-value.

Table 28

The P-value of the Males' Age Group (45 - 54) for the Tracking Systems

The variable values	The actual value of Q5	The actual value of Q9	The expected value or the mean of Q5	The expected value or the mean of Q9
SD	0	1	1	1
D	1	0	1	1
N	1	1	1	1
A	2	3	1	1
SA	1	0	1	1
			P-value	**0.091578194**

Table 28 consists of the P-value of 0.091578194. The P-value of this group is larger or above the value of 0.05, which is the standard P-value for this research.

5.8.3.2.5 Tracking systems and the males' age group (65+)

As discussed in 5.7.2.9.1, there was one male participant with the age group of 65+. The calculation of the P-value for this group would not support or imply the opinion of this group as there was only one participant. For this reason, the calculation of the P-value for this group is disregarded.

5.8.3.2.6 P-values of the males' age groups

The following table (see Table 29) reveals the association between the tracking systems and the males' age groups. The green values are below or less than the standard value of 0.05. However, the red P-value represents that the number is, in fact, more than the standard value.

Table 29

The P-value of the Males' Age Groups for the Tracking Systems

Table No.	Table Title or Description	P-value
Table 25	The P-value of the Males' Age Group (18 - 24)	0.0002991
Table 26	The P-value of the Males' Age Group (25 - 34)	0.000473388
Table 27	The P-value of the Males' Age Group (35 - 44)	0.007295
Table 28	The P-value of the Males' Age Group (45 - 54)	0.091578194

Table 29 shows the P-value of the males' age groups. Unlike the females' age groups (see Table 24), not all the P-values are below or less than the standard value 0.05. One of the P-value is more than or bigger than the standard value of 0.05, meaning that not all the males' age groups are significant. Three out of four groups, however, imply that there is a significance between the tracking systems and the males' age groups. By analysing the P-value, the groups with the P-value of less than 0.05 are age between 18 – 24, 25 – 34, and 35 – 44, implying that age and gender could be a factor for this dependent variable.

5.8.4 P-value and the AI technologies

The following subsections provide the association between gender, age groups, and AI technologies by calculating the P-value using the data set gathered from Q6, Q7, Q8, and Q10. The P-values of less than 0.05 imply the gender, age groups, and AI technologies are significant. If the P-values are more than 0.05, it implies that there is no significance between the gender, age groups, and AI technologies. As mentioned above in section 5.8.1, four questions (Q6, Q7, Q8, and Q10) are related to AI technologies. The corresponding data set of these four questions are used to calculate the P-values. The following subsections provide a detailed analysis of the data set using tables. The values or data used in sections below are the five-point scales rather than the three-point scales.

5.8.4.1 AI technologies and the females' age groups

The below subsections investigate the correlation between the AI technologies and the females' age groups. The calculation and data set used to find the P-value are displayed in tables.

5.8.4.1.1 AI technologies and the females' age group (18 – 24)

The following table (see Table 30) presents the data set of the actual and expected value along with the P-value for the females' age group (18 -24).

Table 30

The P-value of the Females' Age Group (18 - 24) for AI technologies

The variable values	The actual value of Q6	The actual value of Q7	The actual value of Q8	The actual value of Q10	The expected value or the mean of Q6, Q7, Q8 and Q10
SD	1	1	2	2	9.6
D	2	1	2	3	9.6
N	4	7	13	16	9.6
A	31	24	19	21	9.6
SA	10	15	12	6	9.6
				P-value	**1.21698E-27**

Table 30 provides the relationship between AI technologies and the females' age group (18 – 24). The presented data set indicates that the P-value is so small that the Excel application returns the scientific notation rather than the real number, meaning that the P-value for this table is 25 decimals behind the 0.0 (0.0 - 25 zeros between the decimal and this number: 121698), as the minus sign indicated.

5.8.4.1.2 AI technologies and the females' age group (25 – 34)

This subsection looks at the data set of the females' age group (25 – 34) and calculates the P-value of the dependent variable (AI technologies) using the actual and expected value.

Table 31

The P-value of the Females' Age Groups (25 - 34) for the AI Technologies

The variable values	The actual value of Q6	The actual value of Q7	The actual value of Q8	The actual value of Q10	The expected value or the mean of Q6, Q7, Q8 and Q10
SD	0	0	1	2	3.4
D	0	0	1	2	3.4
N	2	3	2	2	3.4
A	12	10	9	8	3.4
SA	3	4	4	3	3.4
				P-value	**2.89419E-10**

Table 31 indicates that the P-value for this group is so small. The P-value is nine decimals behind 0.0, meaning that there is a significance between the AI technologies and the females' age group (25 – 34).

5.8.4.1.3 AI technologies and the females' age group (35 – 44)

The following table (see Table 32) provides a detailed calculation of the P-value for the females' age group (35 – 44). The data set used in this section is retrieved from Q6, Q7, Q8, and Q10.

Table 32

The P-value of the Females' Age Group (35 - 44) for the AI technologies

The variable values	The actual value of Q6	The actual value of Q7	The actual value of Q8	The actual value of Q10	The expected value or the mean of Q6, Q7, Q8 and Q10
SD	1	0	0	0	2.8
D	0	0	0	0	2.8
N	1	1	2	4	2.8
A	7	6	8	10	2.8
SA	5	7	4	0	2.8
				P-value	**7.73868E-11**

Table 32 shows the scientific notation rather than the real number as the P-value is so small. The P-value is nine decimals behind 0.0 and looks like 0.077868. The number indicates that there is a significance between the AI technologies and this group.

5.8.4.1.4 AI technologies and the females' age group (45 – 54)

This section includes the calculation of the P-value for the females' age group (45 – 54). The actual and expected value of the four questions are also displayed in the table (see Table 33).

Table 33

The P-value of the Females' Age Group (45 - 54) for the AI Technologies

The variable values	The actual value of Q6	The actual value of Q7	The actual value of Q8	The actual value of Q10	The expected value or the mean of Q6, Q7, Q8 and Q10
SD	0	0	1	0	3.2
D	1	0	1	1	3.2
N	1	5	1	7	3.2
A	11	6	10	7	3.2
SA	3	5	3	1	3.2
				P-value	**2.72503E-10**

Table 33 displays that the P-value of 2.72503 is eight decimals behind 0.0, meaning that the P-value is so small, and this group and the AI technologies are significant.

5.8.4.1.5 P-values of the females' age groups

This section provides the P-values of the females' age groups, compares the P-values, and finds out whether the values are significant or not. The green values are below or less than the standard value of 0.05.

Table 34

The P-values of the Females' Age groups for AI technologies

Table No.	Table Title or Description	P-value
Table 30	The P-value of the females' Age Group (18 - 24)	1.21698E-27
Table 31	The P-value of the females' Age Group (25 - 34)	2.89419E-10
Table 32	The P-value of the females' Age Group (35 - 44)	7.73868E-11
Table 33	The P-value of the females' Age Group (45 - 54)	2.72503E-10

Table 34 indicates that all the P-values of the females' age groups are below or less than 0.05, implying that the females' age groups and the AI technologies are significant.

5.8.4.2 AI technologies and the males' age groups

The sections below analyse the data set of the males' age groups' responses to the dependent variable (AI technologies) and find out the P-values. The calculation and data set of the actual and expected value used to find the P-value are displayed in tables.

5.8.4.2.1 AI technologies and the males' age group (18 – 24)

This section investigates the relationship between the males' age group (18 – 24) and the AI technologies using the P-value. The table below (see Table 35) provides the data set and the P-value.

Table 35

The P-value of the Males' Age Group (18 - 24) for AI technologies

The variable values	The actual value of Q6	The actual value of Q7	The actual value of Q8	The actual value of Q10	The expected value or the mean of Q6, Q7, Q8 and Q10
SD	0	0	0	0	3.2
D	1	1	4	2	3.2
N	4	2	3	1	3.2
A	6	9	4	9	3.2
SA	5	4	5	4	3.2
				P-value	**1.13723E-05**

Table 35 displays the data set and the P-value for this group. The P-value is so small. Therefore, the scientific notation is displayed rather than the actual number. The P-value is 0.0000113723, and it is less than the standard P-value 0.05.

5.8.4.2.2 AI technologies and the males' age group (25 – 34)

The table of this section provides the actual and expected value of the males' age group (25 – 34). The calculation of the P-value is carried out in this section.

Table 36

The P-value of the Males' Age Group (25 - 34) for the AI technologies

The variable values	The actual value of Q6	The actual value of Q7	The actual value of Q8	The actual value of Q10	The expected value or the mean of Q6, Q7, Q8 and Q10
SD	0	3	1	2	3.4
D	4	2	3	2	3.4
N	4	4	2	5	3.4
A	6	4	7	3	3.4
SA	3	4	4	5	3.4
				P-value	**0.213752522**

Table 36 presents the P-value of 0.213752522, which is above the standard value of 0.05, implying that there is no significance between this group and the AI technologies.

5.8.4.2.3 AI technologies and the males' age group (35 – 44)

This section investigates the correlation between AI technologies and the males' age group (35 – 44). The table provided below (see 29) shows the P-value.

Table 37

The P-value of the Males' Age Group (35 -44) for the AI Technologies

The variable values	The actual value of Q6	The actual value of Q7	The actual value of Q8	The actual value of Q10	The expected value or the mean of Q6, Q7, Q8 and Q10
SD	0	0	0	1	1.6
D	1	2	0	1	1.6
N	2	3	2	2	1.6
A	3	3	6	3	1.6
SA	2	0	0	1	1.6
				P-value	**0.00553205**

Table 37 unveils the P-value of the males' age group, which is 0.00553205. The value is less than the standard value of 0.05, meaning that this group and the AI technologies are significant.

5.8.4.2.4 AI technologies and the males' age group (45 -54)

This section analyses the data set of the males' age group (45 – 54) and finds out the P-value. The actual and expected value is also presented in the table provided below (see Table 38).

Table 38

The P-value of the Males' Age Group (45 - 55) for the AI technologies

The variable values	The actual value of Q6	The actual value of Q7	The actual value of Q8	The actual value of Q10	The expected value or the mean of Q6, Q7, Q8 and Q10
SD	0	0	0	0	1
D	0	0	0	0	1
N	2	1	1	2	1
A	2	3	4	1	1
SA	1	1	0	2	1
				P-value	**0.01073389**

Table 38 presents the P-value of this group, which is 0.01073389. The P-value of this group is smaller than or below the standard value of 0.05. Therefore, this group and AI technologies are significant.

5.8.4.2.5 AI technologies and the males' age group (65+)

As stated in section 5.7.2.9.1, there was one male respondent with the age of 65+. One participant could not present the whole group's opinion. Therefore, the data set for this age group is disregarded.

5.8.4.2.6 P-values of the males' age groups

This section concludes the calculations of P-values for the males' age groups and AI technologies. The table provided below (see Table 39) compared the P-value and decided whether the groups are significance with the AI technologies or not. The green values indicate that they are below or less than the standard value. On the other hand, the red value means that the number is above or more than the standard value.

Table 39

The P-value of the Males' Age Groups for the AI Technologies

Table No.	Table Title or Description	P-value
Table 35	The P-value of the males' Age Group (18 - 24)	1.13723E-05
Table 36	The P-value of the males' Age Group (25 - 34)	0.213752522
Table 37	The P-value of the males' Age Group (35 - 44)	0.00553205
Table 38	The P-value of the males' Age Group (45 - 54)	0.01073389

Table 39 displays that three out of four P-values are less than the standard value of 0.05, ensuring that the three groups and AI technologies are significant. Only one P-value is not significant with AI technologies.

5.8.5 P-value and the expectations of AI

The following sections investigate the association between the gender, age groups, and the expectations of AI using the data gathered from Q11, Q12, and Q13 by calculating the P-values. As mentioned in section 5.8, the standard P-value for this research is set at 0.05. If the P-values calculated in the following sections are more than 0.05, it can be considered as there is no significance between the expectation of AI, gender, and age groups. However, if the P-values of the following sections are less than or below the standard P-value 0.05, it implies that there is a significance between the gender, age groups, and the expectations of AI. The data gathered from Q11, Q12, and Q13 are used to calculate the P-value. The data sets used in the following sections are five-point scales.

5.8.5.1 Expectations of AI and the females' age groups

The following subsections analyse the data using a table format. The sections find out the relationship between the females' age groups and the expectations of AI.

5.8.5.1.1 Expectations of AI and the females' age group (18 – 24)

This section analyses the data retrieved from the females' age group (18 – 24). The actual and expected value of the data are also presented in the table below (see Table 40).

Table 40

The P-value of the Females' Age Group (18 - 24) for the Expectations of AI

The variable values	The actual value of Q11	The actual value of Q12	The actual value of Q13	The expected value or the mean of Q11, Q12, and Q13
SD	5	4	3	9.6
D	2	1	4	9.6
N	9	16	7	9.6
A	22	21	27	9.6
SA	10	6	7	9.6
			P-value	**4.13705E-17**

Table 40 presents the P-value for this group of 4.13705E-17, which is a scientific notation rather than the actual number, meaning that the value is so small and 15 decimals behind 0.0. The P-value for this group is less than or below the standard value of 0.05.

5.8.5.1.2 Expectations of AI and the females' age group (24 – 35)

This section finds out the association between the expectations of AI and the females' age group (24 – 35) using the actual and expected value along with the calculation of the P-value.

Table 41

The P-value of the Females' Age Group (25 - 34) for the Expectations of AI

The variable values	The actual value of Q11	The actual value of Q12	The actual value of Q13	The expected value or the mean of Q11, Q12, and Q13
SD	0	1	1	3.4
D	0	1	1	3.4
N	2	5	3	3.4
A	11	10	11	3.4
SA	4	0	1	3.4
			P-value	**1.99168E-11**

Table 41 provides the data set of this group and the P-value. The P-value is small, and it is showing the scientific notation. The actual value (0.0 nine zeros between the decimal and this number: 199168) for this group is nine decimals behind 0.0. The P-value is less than the standard P-value of 0.05.

5.8.5.1.3 Expectations of AI and the females' age group (35 – 44)

This section provides the P-value of the females' age group (35 – 44) for the expectations of AI. The actual and expected value is also presented in the table provided below (see Table 42).

Table 42

The P-value of the Females' Age group (35 - 44) for the expectations of AI

The variable values	The actual value of Q11	The actual value of Q12	The actual value of Q13	The expected value or the mean of Q11, Q12, and Q13
SD	0	0	0	2.8
D	0	0	0	2.8
N	1	2	2	2.8
A	10	9	7	2.8
SA	3	3	5	2.8
			P-value	**8.32585E-10**

Table 42 shows the actual and expected value along with the P-value for this group. The P-value is smaller than the standard value as the scientific notation is used. The P-value is eight decimals behind 0.0.

5.8.5.1.4 Expectations of AI and the females' age group (45 – 54)

This section analyses the actual and expected value of the females' age group (45 – 54) and provides the P-value to consider the significance between the expectations of AI and this group.

Table 43

The P-value of the Females' Age Group (45 - 54) for the Expectations of AI

The variable values	The actual value of Q11	The actual value of Q12	The actual value of Q13	The expected value or the mean of Q11, Q12, and Q13
SD	0	0	0	3.2
D	0	0	0	3.2
N	1	2	2	3.2
A	10	9	7	3.2
SA	3	3	5	3.2
			P-value	**1.42032E-10**

As seen in Table 43, the P-value is so small, and it is a scientific notation. The P-value for this group is eight decimals behind 0.0. This value is smaller than the standard P-value of 0.05.

5.8.5.1.5 P-value of the females' age groups

This section provides a table (see Table 44) that combines the P-value of the females' age groups, analyses the results and finds out whether there is a significance between the females' age groups and the expectations of AI. The green values represent that they are below or less than the standard value of 0.05.

Table 44

The P-values of the Females' Age Groups for the Expectations of AI

Table No.	Table Title or Description	P-value
Table 40	The P-value of the males' Age Group (18 - 24)	4.13705E-17
Table 41	The P-value of the males' Age Group (25 - 34)	1.99168E-11
Table 42	The P-value of the males' Age Group (35 - 44)	8.32585E-10
Table 43	The P-value of the males' Age Group (45 - 54)	1.42032E-10

As shown in Table 44, all the P-values for the females' age groups are less than or below the standard P-value of 0.05, indicating that there is a significance between the expectations of AI and the females' age groups.

5.8.5.2 Expectations of AI and the males' age groups

The subsections below investigate the correlation between the males' age groups and the expectations of AI using the data retrieved from Q11, Q12, and Q13. The tables used in these sections provide the actual and expected value from the questions.

5.8.5.2.1 Expectations of AI and the males' age group (18 – 24)

This section uses the data gathered from the males' age group's (18 -24) responses for Q11, Q12, and Q13 to calculate the P-value. The actual and expected value are presented in the table (see Table 45).

Table 45

The P-value of the Males' Age Group (18 -24) for the Expectations of AI

The variable values	The actual value of Q11	The actual value of Q12	The actual value of Q13	The expected value or the mean of Q11, Q12, and Q13
SD	0	0	0	3.2
D	1	1	1	3.2
N	3	5	2	3.2
A	5	5	5	3.2
SA	7	5	8	3.2
			P-value	**0.000120467**

As depicted in Table 45, the P-value for this group is less than or smaller than the standard P-value, meaning that the expectations of AI and this group are significant.

5.8.5.2.2 Expectations of AI and the males' age group (25 – 34)

This section calculates the P-value of the males' age group (25 – 34) using data gathered from Q11, Q12, and Q13. The actual and expected value of these questions are also displayed in the table (see Table 46).

Table 46

The P-value of the Males' Age Group (25 - 34) for the Expectations of AI

The variable values	The actual value of Q11	The actual value of Q12	The actual value of Q13	The expected value or the mean of Q11, Q12, and Q13
SD	2	1	3	3.4
D	2	5	0	3.4
N	2	5	4	3.4
A	7	3	5	3.4
SA	4	3	5	3.4
			P-value	**0.081765416**

Table 46 presents the P-value that is lager or above the standard P-value of 0.05. The assumption of which there is no significance between the expectations of AI and this group can be made.

5.8.5.2.3 Expectations of AI and the males' age group (35 – 44)

This section analyses the data set provided by the males' age group (35 – 44) and calculates the P-value for this group. The actual and expected value of this group is also presented in the table (see Table 47).

Table 47

The P-value of the Males' Age Group (35 - 44) for the Expectations of AI

The variable values	The actual value of Q11	The actual value of Q12	The actual value of Q13	The expected value or the mean of Q11, Q12, and Q13
SD	1	0	0	1.6
D	1	0	0	1.6
N	0	2	1	1.6
A	5	3	6	1.6
SA	1	1	1	1.6
			P-value	**0.000211379**

Table 47 indicates that the P-value for this group is smaller than the standard P-value of 0.05. Therefore, there is a significance between the expectations of AI and this group.

5.8.5.2.4 Expectations of AI and the males' age group (45 – 54)

This section includes the calculation of the P-value for the males' age group (45 – 54). Once the P-value is calculated, the assumption of whether there is a significance between the expectations of AI and this group can be drawn. The actual and expected value are provided in the table (see Table 48).

Table 48

The P-value of the Males' Age Group (45 - 54) for the Expectations of AI

The variable values	The actual value of Q11	The actual value of Q12	The actual value of Q13	The expected value or the mean of Q11, Q12, and Q13
SD	0	0	0	1
D	0	0	0	1
N	2	3	1	1
A	2	2	4	1
SA	1	0	0	1
			P-value	**0.002291791**

Table 48 shows that the P-value for this group is smaller or below the standard value of 0.05. As the value is smaller, the assumption of a significance between the expectations of AI and this group can be made.

5.8.5.2.5 P-value of the males' age groups

This section presents a table (see Table 49) of all the P-values for males' age groups for the expectations of AI.

Table 49

The P-values of the Males' Age Groups and the Expectations of AI

Table No.	Table Title or Description	P-value
Table 45	The P-value of the males' Age Group (18 - 24)	0.000120467
Table 46	The P-value of the males' Age Group (25 - 34)	0.081765416
Table 47	The P-value of the males' Age Group (35 - 44)	0.000211379
Table 48	The P-value of the males' Age Group (45 - 54)	0.002291791

As seen in Table 49, three out of four P-values are smaller or less than the standard P-value of 0.05, implying that there is a significance between these groups and the expectations of AI. However, one value is above the standard value, meaning that there is no significant between this particular group and the expectations of AI.

5.9 Conclusion

This chapter discussed the detailed analysis of the data retrieved from the survey using tables and figures. Firstly, the raw data were turned into manageable data by applying codes and putting them into spreadsheets. The data were then used for the radar-charts, pie-charts, and the calculations of the P-values. Dividing the independent variables, the gender and age groups, into groups allows the research to create a thorough analysis of the dependent variables. At the end of each section, a table is created to put the outcomes into a viable data set to discuss in the next chapter.

The next chapter discusses the outcomes of this chapter and links with the conceptual framework (TTF) mentioned in section 4.3.3. By using the dependent and independent variables, the research can put the literature findings as groups and link it with the dependent variables that are connected to TTF. After the discussion of the independent and dependent variables, the hypotheses, RQs, the results of analysis and the literature findings are linked together in the next chapter.

6. Discussion

An overview of this chapter

Chapter 6 includes the introduction to the chapter, the relationships between the independent and dependent variables, the hypotheses, and RQs. The TTF model is also used to justify the use of the independent and dependent variables. The radar-charts created in chapter 5 are also compared to each other by grouping them into gender and age groups. The justifications as to why hypotheses are considered to be approved or unapproved along with the relationships between the hypotheses and RQs are discussed in this chapter. Finally, RQs are answered by using the outcome of the hypotheses.

6.1 Introduction

This chapter looks into the analysis performed in Chapter 5 and uses the results to answer the RQs and test the hypotheses. The independent variables of age groups and gender are used to differentiate the actual tool use and individual performance of the TTF model. The task requirements and tool functionalities of the three dependent variables of tracking systems, AI technologies, and the expectations of AI are described using the independent variables. Radar-charts performed in Chapter 5 are grouped by age groups and gender to compare and to find out the differences and similarities.

Hypotheses are discussed one by one, using the results and outcome of Chapter 5 and findings from this chapter. The discussion also includes the relationship between RQs and the hypotheses to answer the RQs. Section 6.2 discusses the variables and the conceptual framework (TTF) using figures. Section 6.2.2 looks into the relationship between the independent variables, the actual tool use, and the individual performance. Section 6.2.3 uses the dependent variables, tracking systems, AI technologies, and the expectations of AI to find out the effect these variables have on independent variables. Section 6.3 consists of the discussions and testing of hypotheses and RQs.

6.2 Variables and the conceptual framework (TTF)

In this section, the discussion of the relationships between the independent variables, dependent variables, and how these variables are related to the conceptual framework (TTF) is carried out. Figure 22 provided below presents the links between the variables and the framework. By using the findings from the literature review (see Chapter 3) and the analysis of data (see Chapter 5), the interconnections of the TTF framework and the variables are discussed in detail. The TTF model with the independent and dependent variables is provided below (see Figure
22).

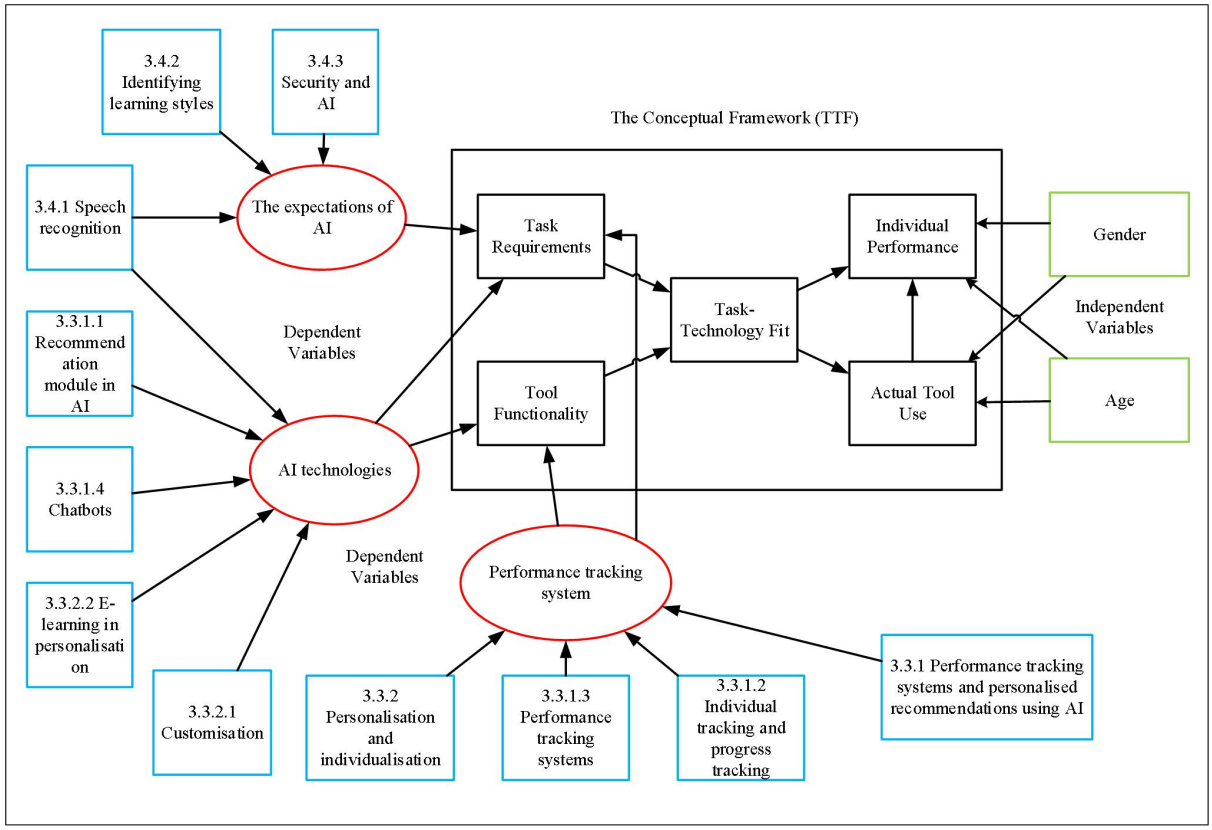

Figure 22. The TTF Model with the Independent and Dependent Variables

6.2.1 Independent variables and the conceptual framework (TTF)

There are two independent variables (see Figure 22), gender and the age groups. At the time of conducting the survey, these two independent variables were constant or accurate, which is why these two variables were chosen above the others as the independent variables rather than the platform and the role (see section 5.3).

As shown in Figure 22, the gender and age groups are connected to individual performance and Actual Tool Use of the TTF framework.

6.2.1.1 Gender and the TTF framework

There are two gender groups in this research, female and male. As Dabaj (2009) found out, gender and age affected teaching and learning (p. 4). Also, Legewie and DiPrete (2012) examined the claim of males underperforming in education than females (p. 464). Legewie and DiPrete (2012) found out that even though the gap between the female and male graduates is closing, there was no sign of males being more productive in other subjects than maths (480). Legewie and DiPrete (2012) also concluded that males had higher graduation rates in applied sciences (i.e., Computer Science and Information Technology) than females (p. 482).

6.2.1.1.1 Gender and Individual Performance

As shown in Figure 22, gender is connected to individual performance. The intention of asking Q11 was to figure out whether individuals would use AI technologies if they were proven to be effective in learning. As seen in Table 50, the results of Q11 can be divided into gender groups, females and males.

Table 50

The results of Q11 for Females and Males

Age Groups	Females	Males
18 - 24	66.66%	75%
25 – 34	88.24%	64.71%
35 – 44	92.86%.	75%
45 - 54	75%	60%

By looking at Table 50, there are significant differences between males' and females' responses to Q11. As suggested above, males are likely to underperform in education. With that claim in mind, even if there is a chance to improve their performance by using AI technologies in education, they refuse. Apart from the females' age group (18 – 24) that has a low percentage compared to other females' groups, all of the other groups are dominated by females' groups, according to Table 50, implying that they would use AI to improve their performances.

6.2.1.1.2 Gender and Actual Tool Use

Huffman, Whetten, and Huffman (2013) mentioned that females were less likely to receive education regarding technology as the area of technology considered to be male-oriented (p. 1784). Sanders (2005) also found out that female pre-teacher education students were anxious to engage with technology (p. 21). She also mentioned that males were likely to have more experience in technology (p. 9). Another thing she found out was that females were more anxious to use technology compared to males (p. 11). Universities should adjust the teaching methods and strategies to accommodate both genders by using bisexual teaching methods (Huffman et al., 2013).

As the gender is connected to Actual Tool Use (see Figure 22), the findings from the analysis of Table 51 reveal that even with a higher population of female participants, there is a slight differentiation of responses to Q13. Q13 was included in asking if the participants would use these AI technologies mentioned in section 3.3.

Table 51

The results of Q13 for Female and Male

Age Groups	Females	Males
18 - 24	70.83%	81.25%
25 – 34	70.59%	58.82%
35 – 44	85.71%.	87.5%
45 - 54	75%	80%

Turning these numbers in Table 51 into the average percentage returns 75.53% for females and 76.9% for males. Even though the number of female respondents outweighs the number of male respondents by two-third, according to Figure 8, females were reluctant to use AI technologies. Even with fewer respondents' population for males, there is over one percent difference in using AI technologies in education. Although there is no significant difference between the two values, it shows that females may still have anxiety towards using technologies.

6.2.1.2 Age groups and the TTF Framework

Four main age groups were analysed in Chapter 5, 18 – 24, 25 – 34, 35 – 44, and 45 – 54. Kimmel, Gaylor, and Hayes (2016) mentioned that there is a significance between age differences for studying in higher education. Kimmel, Gaylor, and Hayes (2016) suggested that teachers should consider both spectra and manage accordingly. One of the ways, Kimmel, Gaylor, and Hayes (2016), suggested was building groups as mentoring and generational learning (p. 27).

6.2.1.2.1 Age and Individual Performance

Q11 provides the necessary information to understand the correlation between age groups and individual performance. Although Q11 did not measure the performances of students in any way, asking if they would use AI that were effective in learning and teaching, would indicate that they were willing to improve their performances. As Table 50 pointed out, all age groups agreed or would like to use AI if they had a positive impact on education. Amongst the females' age groups, the females' age groups of (25 – 34) and (35 – 44) indicate that they would use AI if proven to be effective as they have higher percentages than the other groups. Even though the females' age group (18 – 24) has the highest participant number (48) compared to other groups, they have the lowest percentage for using AI to improve their performances. As Chung, Park, Wang, Fulk, and McLaughlin (2010) mentioned, there was no link between age differences and the acceptance of the technology, even though there was a factor of efficiency of using technology (p. 1681).

6.2.1.2.2 Age and Actual Tool Use

As stated in the above section 6.2.1.2.1, there was no relation between the age differences and the use of technology. Table 51, the results of Q13, shows that there is no significant difference between the age groups in terms of using AIED as Q13 asked the question of using AI technologies. The females' age group (35 to 44) has more percentages than the other three groups and expressed that they would use these AI technologies mentioned in section 3.3, according to Table 51. As for males, the males' age group (25 – 34) has a significantly lower percentage when compared to other groups.

6.2.2 Independent variables and Q5 to Q13

This section provides a detailed analysis of the comparisons between the females' age group's responses and the males' age group's responses from Q5 to Q13. The radar-charts provided in section 5 are used to compare differences between the female and male groups according to their age groups. Analysing the groups gives an idea of what different gender and age groups consider AIED in more detail.

6.2.2.1 The comparisons of females' and males' age groups' (18 – 24)

This section analyses the radar-charts of the females' and males' age groups (18 – 24) for Q5 to Q13 using Figure 23.

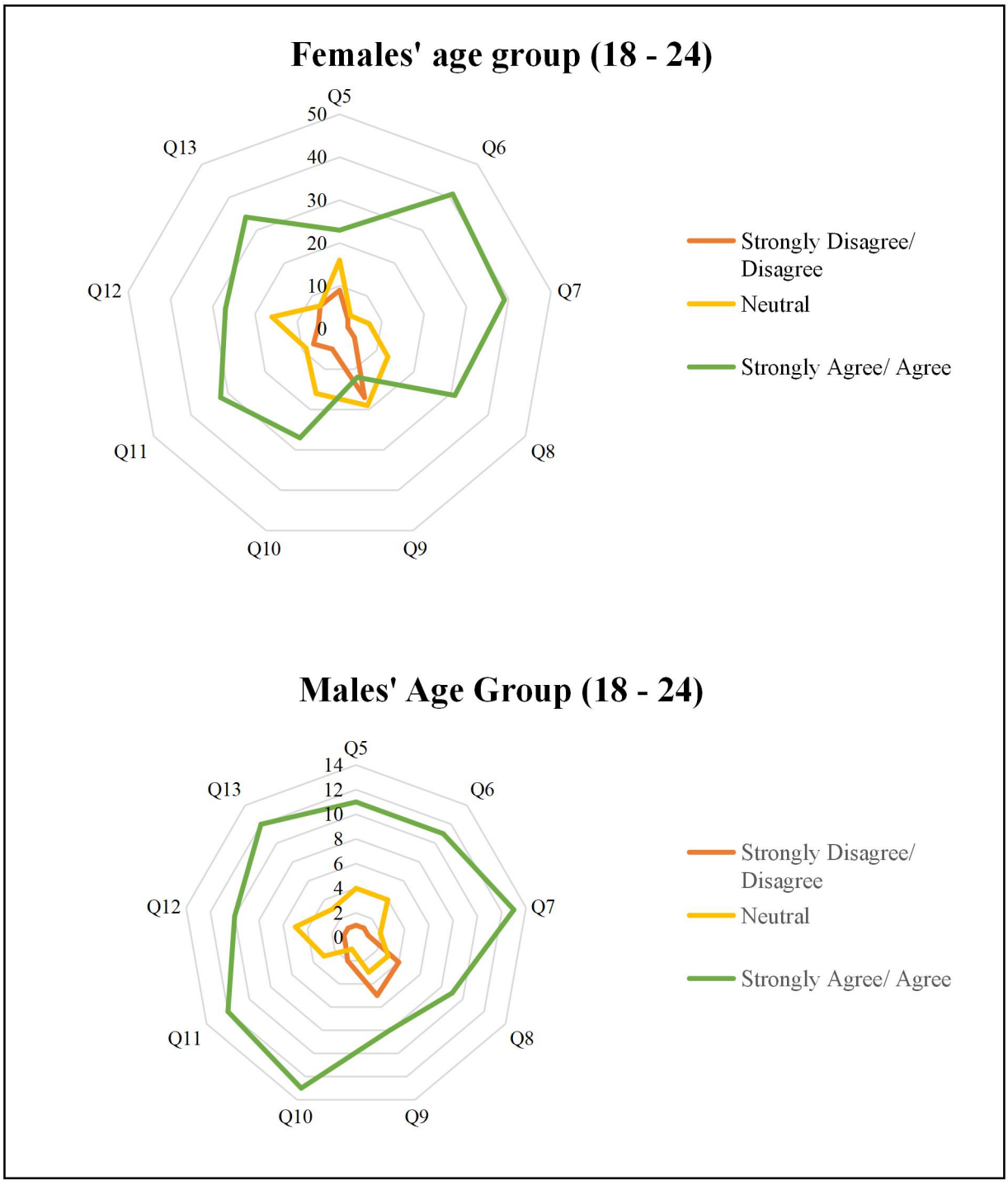

Figure 23. The Radar-Charts of Females' and Males' Age Groups (18 - 24)

As shown in Figure 23, there is consistency in the shape of Q11, Q12, and Q13, as well as Q6, Q7, and Q8 for SA/A. Looking at Q11, Q12, and Q13 shows that both groups agree to the Q11 and Q13 more than Q12. The percentages of those questions also indicated that, in fact, Q12 had fewer percentages (56.25% and 62.5%) than the other two (see Table 11 and Table 15).

As for the shape of Q5 and Q9, females' radar-chart is more concave than males' radar-chart. However, both charts indicate that Q9 has the least responses for SA/A and the most SD/D responses with the percentages of 35.42% and 31.25% accordingly. Figure 23 also shows that females answered N for most of Q9 with a percentage of 39.58%, according to Table 11. Q5 has the second least SA/A response. Analysing Figure 23 pointed out that respondents would use AI if there were a proven positive impact on education. Although they would use AI, there was also a security concern around AI as they were sceptical about using tracking systems as the shape of radar-charts suggested.

In terms of Q6 (OLEs), Q7 (RM), and Q8 (AI tutors), out of three AI technologies, they would use RM and OLEs more than AI tutors. Q6 and Q7 had more SA/A responses than Q8, as Figure 23 shows. For Q10, males responded that they would like the idea of using Chatbots as Q10 had the same percentage of SA/A as the Q7 with 81.25%. Female group, on the other hand, was not convinced with the idea, and only 56.25% answered SA/A for Q10, which was one of the lowest SA/A from the females' group.

6.2.2.2 The comparisons of females' and males' age groups' (25 – 34)

This section uses the radar-charts provided in Figure 24 to analyse the shape and results of the females' and males' age groups (25 – 34).

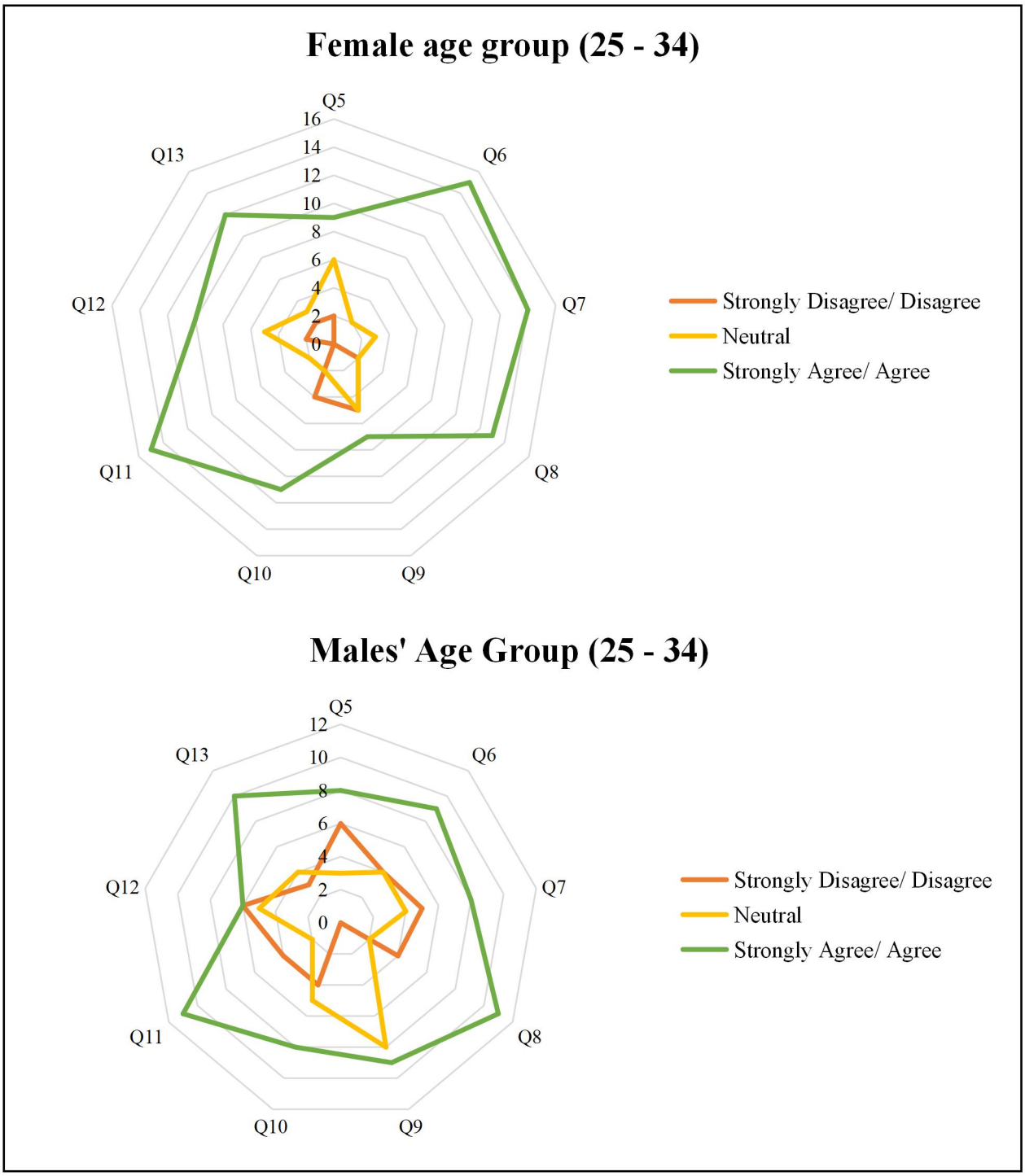

Figure 24. The Radar-Charts of Females' and Males' Age Groups (25 - 34)

Figure 24 shows that the shapes of the two radar-charts are different from each other. The female group's radar-chart of Figure 24 resembles the female group's radar-chart of Figure 23. The male group's radar-chart of Figure 24, however, had a different pattern to the male group's radar-chart of Figure 23. As discussed in section 4.11, there are limitations when doing an online survey. One of them is data accuracy. Due to the lack of supervision from the researcher as the survey conducted for this research was a convenience survey, there might be a matter of giving evasive answers. Another issue is misunderstanding or misinterpretation of questions. There might be a good chance that respondents did not fully understand the questions, or they did not have enough experience to answer the questions.

The pattern of the females' group is consistent with others, as discussed. Q7 is one of the most agreed questions with the percentages of Figure 23 is above 80%, and the percentage of Figure 24 of females' group's radar-chart is also above 80% for Q7. However, Figure 24 of males' group's radar-chart indicates that Q7 is one of the lowest agreed questions. Another difference is that Q9 of Figure 23 and females' group's radar-chart of Figure 24 shows that Q9 is one of the most disagreed questions (see Table 11, Table 12 and Table 15). But, Figure 24 of males' group's radar-chart had zero disagreed responses (see Table 16). Other responses are quite similar to other groups. Even though Q12 is not one of the most agreed questions, the average percentage of SA/A for Q12 is over 55%. The males' group's radar-chart of Figure 24 shows that SA/A and SD/D are the same percentages with 35.30% (see Table 16).

Looking at the pattern of Figure 23 and Figure 24 reveals that females' groups have a consistent pattern. Males' groups, on the other hand, do not appear to have a consistent pattern to it.

6.2.2.3 The comparisons of females' and males' age groups' (35 – 44)

This section analyses the radar-charts of the females' and males' age group (35 – 44). Figure 25 presents the radar-charts.

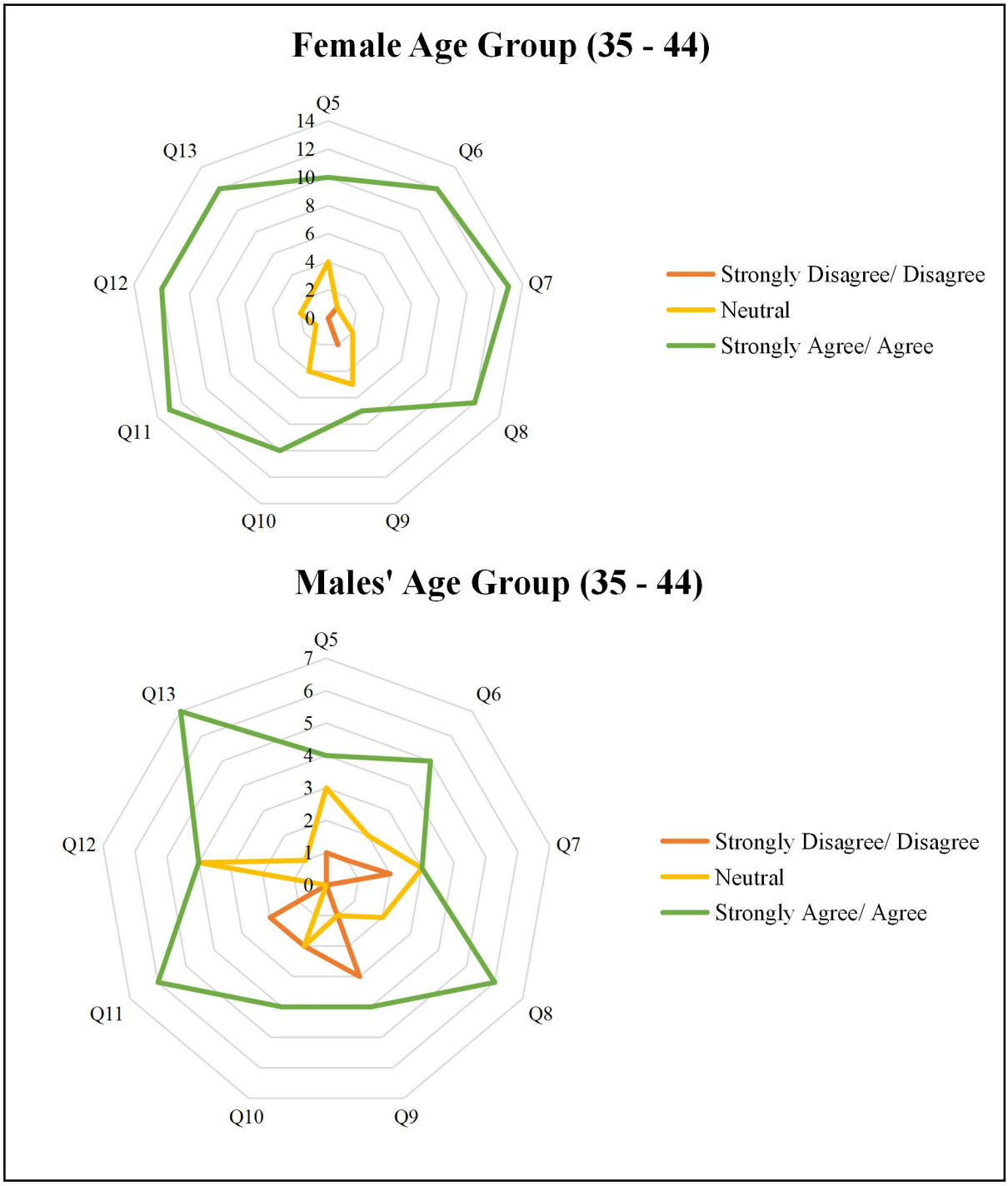

Figure 25. The Radar-Charts of the Females' and Males' Age Groups (35 - 44)

As shown in Figure 25, the two patterns of the females' and males' groups are different from each other. The males' group's radar-chart of Figure 25 seems to have a similar pattern to Figure 24's males' group's radar-chart.

Q8, Q11, and Q13 of Figure 25 have a similar SA/A pattern to each other. Table 13 and Table 17 support this claim with the percentages of 85.71%, 92.86%, and 85.71% for females' age group (35 – 44) and 75%, 75%, and 87.5% for males' age group. These percentages hold more significant percentages, according to Table 13 and Table 17. The most surprising outcome of Figure 25 is that Q7 has a different pattern. 92.86% of the female's group agreed to Q7. On the contrary, males' group answered the percentage of 37.5% for both SA/A and N. Another difference is Q12. Females' group responded with SA/A of 85.71%. However, males' group answered 50% for both SA/A and N to Q12.

Other questions, Q5, Q6, Q9, and Q10, have similar patterns to each other compared to other questions mentioned above (see Table 13 and Table 17).

6.2.2.4 The comparisons of females' and males' age groups' (45 – 54)

This section investigates the similarities and differences between the two radar-charts of the females' and males' age group (45 – 54).

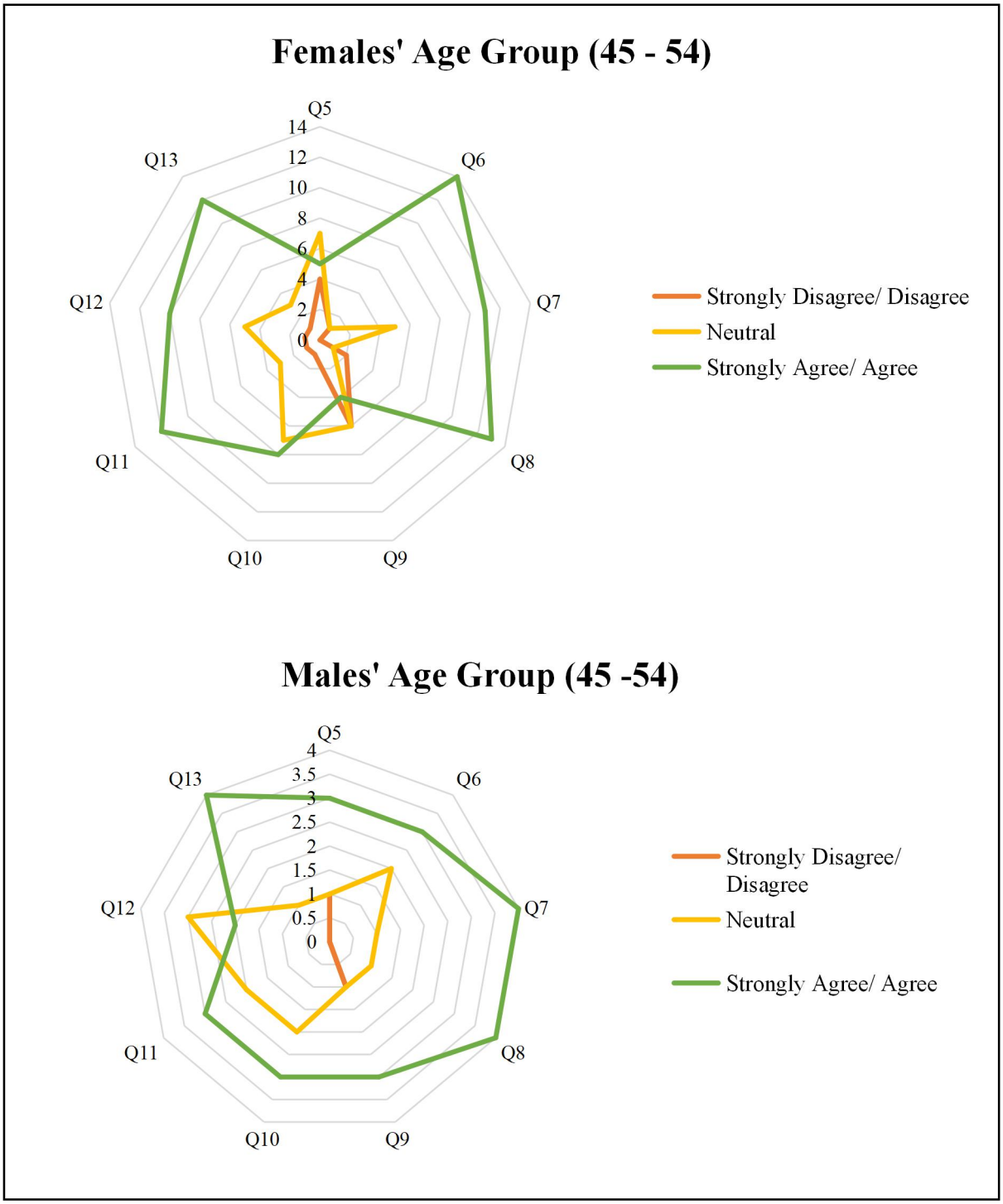

Figure 26. The Radar-Charts of the Females' and Males' Age Groups (45 – 54)

Looking at Figure 26 indicates that the patterns of the females' and males' groups are different. Females' group's pattern resembles the females' radar-charts of Figure 23 and Figure 24. The males' radar-chat of Figure 26 has a reasonably similar pattern to the males' radar-chart of Figure 24.

Q9 of females' group has the percentages of 37.50% for N and SD/D, which is the highest percentage for SD/D compared to other questions. Males' group has 60% of SA/A for Q9. Although the percentage is not the highest, the percentage indicates that they would feel safe using AI tracking systems. Another difference is Q12. Males' group has 60% for N, which is the highest for this males' group. 62.5% of the females' group agreed to Q12. Both the radar-charts have a high agreement percentage for Q7, Q8, Q11, and Q13.

Females' group has the highest N percentage of 43.75% for Q5, according to Table 14. Both groups have similar percentages for Q10 with 50% for females' group and 60% for males' group. Q6 for females' group's percentage is 87.50%, as seen in Table 14, however, only 60% for males' group, according to Table 18.

6.2.2.5 The results of females' and males' age groups for Q5 to Q13

After looking at Figure 23, Figure 24, Figure 25, and Figure 25, females' groups constantly have the same pattern for Q6, Q7, Q8, Q11, and Q13. As for males' groups, Only Q11 and Q13 have similar patterns. These findings show that they all have similar opinions for Q11 and Q13 with the average percentages of 80.7% for Q11 from females' groups and 68.68% of Q11 from males' groups, as for Q13, 75.53% from females' groups and 76.9% from males' groups.

6.2.3 Dependent variables and the conceptual framework (TTF)

Dishaw and Strong (1999) discussed that the TTF model was to measure the utilisation of IT performance (p. 11). The main focus of the TTF model is to find out the task requirements (the demands of tasks) and the tool functionality (the capabilities of technology) as well as how they fit together (Dishaw & Strong, 1999, p. 11). As mentioned in Table 3, there are three main dependent variables, tracking systems, AI technologies, and the expectations of AI. In the following sections, a detailed discussion of each of these variables is presented along with the findings from the Literature Review (see Chapter 3) and the outcomes of the Analysis (see Chapter 5). Furthermore, the results of the questions associated with the three dependent variables are also included to support the findings.

The findings of the three dependent variables are based on the two independent variables (gender and age groups). The following sections discuss the dependent variables using the gender and age groups as reference points (see Figure 27, 28, and 29).

6.2.3.1 Tracking systems and the conceptual framework (TTF)

As shown in Figure 22, the dependent variable (Tracking Systems) is connected to or linked with the task requirements and tool functionality.

According to the Literature Review (see Chapter 3), the tool functionalities of the tracking systems are to track or follow the development of students' performances and progress of students (see section 3.3.1.2 and 3.3.1.3). Individual tracking or progress tracking is to track the progression of students over time by providing the necessary information (i.e., what type of students they are, and what materials to study). The main task of performance tracking systems is to measure the performance of students during tests and their overall performance of courses (Samarakou et al., 2015, p. 22).

The task requirements of tracking systems are to provide students with a better platform using OLEs as learning or study tools while supporting students with better quality content, identifying the type of students they are, using a questionnaire or test (Chen, 2010; Liew et al., 2015; Magdalena, 2015), providing personalised learning materials, and follow their development while studying. To perform all of the task requirements, Jaimes and Sebe (2007) suggested using Adaptability that allows students to create their OLE using E-learning or LMS. For the creation of students' OLE to happen, other AI technologies such as RM and E-learning should be incorporated as one platform. However, creating such complex and complicated platform would require a lot of data processing and current LMSs cannot

provide the necessary components (i.e., hardware and software) (Graf & Kinshuk, 2009; Seeber et al., 2019). The table below (see Table 52) provides the findings from the literature review for task requirements and tool functionality for tracking systems.

Table 52

The Literature Findings of Tracking Systems

Tracking Systems	
Task Requirements	**Tool Functionality**
- OLEs with better platform - Quality content - Identifying types of students - RM - E-learning - Personalised learning environment	- Performance tracking systems - Progress or individual tracking - Following the development of students

6.2.3.1.1 The significance of tracking systems

When conducting the survey, Q5 and Q9 were included in asking respondents' opinions on tracking systems. The data from these questions were used in Chapter 5 to turn into the P-values that calculate the significance between two variables, the independent and dependent variables. As mentioned above, the gender and age groups are used to find the significance of tracking systems (see section 6.2.3). The following sections discuss the significance of gender, age groups, and tracking systems. Figure 27 shows the relationship between the independent and dependent variables using the P-values to find the significance.

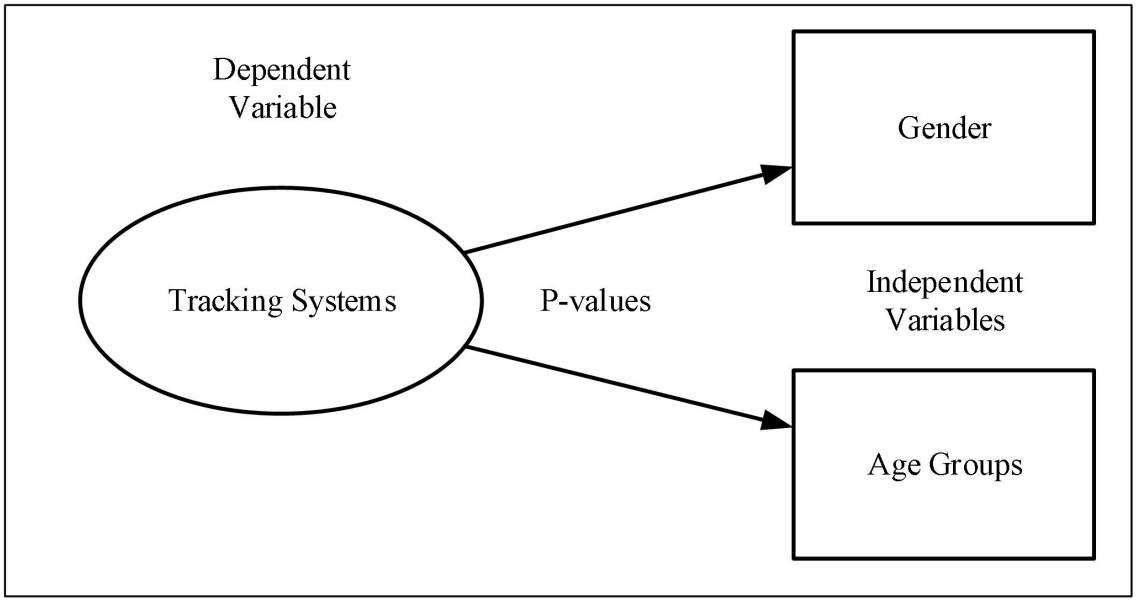

Figure 27. The Relationship between the Independent Variables (Gender and Age Groups) and Dependent Variable (Tracking Systems)

6.2.3.1.1.1 The females' age groups and tracking systems

Table 24, shown in section 5.8.3.1.5, provides the P-values of the females' age groups for tracking systems. The standard P-value of this research is 0.05 (see section 5.8). All the P-values for females' age groups are less than or below the standard P-value of 0.05, meaning that the females and tracking systems are significant. This finding can be translated as female with all age groups of this research will be affected, or the tracking systems will have an impact on them if the tracking systems are implemented in education. The following figure (see Figure 28) provides the relationship between the females' age groups and tracking systems.

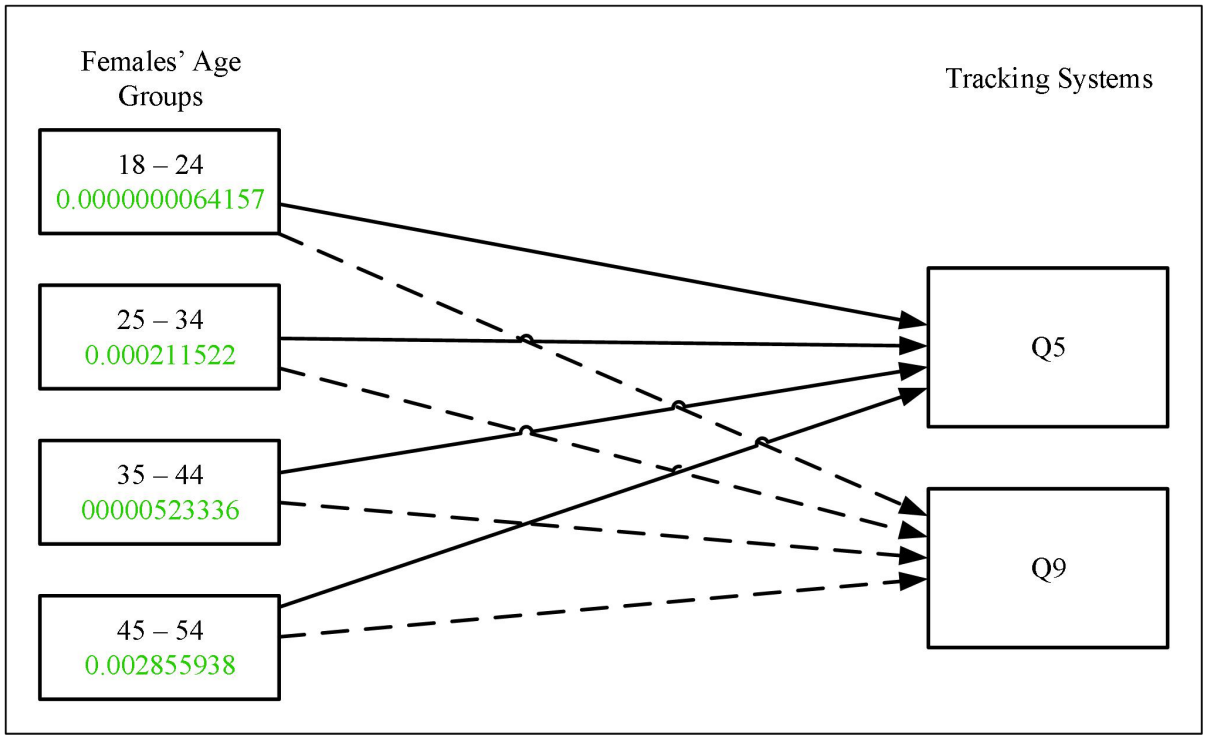

Figure 28. The Significance between the Females' Age Groups and Tracking Systems

As there are two survey questions related to tracking systems, each question is discussed separately below. The table below provides the percentages of both Q5 and Q9 (see Table 53). The red highlights indicate the most significant percentages.

Table 53

The Results of Tracking Systems for the Females' groups

Questions No.	SD/D	N	SA/A
Q5	13.88%	35.23%	50.89%
Q9	29.16%	35.5%	35.3%

Referring to Q5, findings from Tables 11, 12, 13, and 14 revealed that the average percentage of females who thought using tracking systems would improve the performance of students is 50.89%, according to Table 53. The number 50.89% was just over half of the female respondents' population. 13.88% of females believed that tracking systems would not improve students' performances as they disagreed with the Q5. N was 35.23%, meaning that 35.23% of females were not sure if tracking systems would make any difference to education.

For Q9, the average female respondent's population, who would not feel safe if AI tracking systems were running in their online environment, was 29.16% as they disagreed with the idea of using AI tracking systems. On the other hand, 35.3% of them would like to have AI tracking systems in education as they responded SA/A for Q9, according to Table 53. 35.5% of the whole female respondent's population, however, did not have a clear answer or understanding of tracking systems as they chose N.

Looking at Table 53, Q5 has a decisive answer of 50.89% SA/A, which means females believe that using AI tracking systems would have a positive impact on education. Q9 did not have a clear answer, as the percentages are evenly distributed amongst the three options.

6.2.3.1.1.2 The males' age groups and tracking systems.

Table 29 shows that not all the P-values of the males' age groups have less than or below the standard P-value of 0.05. The males' age group (45 – 54) has the P-value of 0.091578194, which is more than the standard P-value, indicating that there is no significant between this males' group and tracking systems. Other groups have P-values less than 0.05. Figure 29 presents the significance between the males' age groups and tracking systems using the data from Table 54.

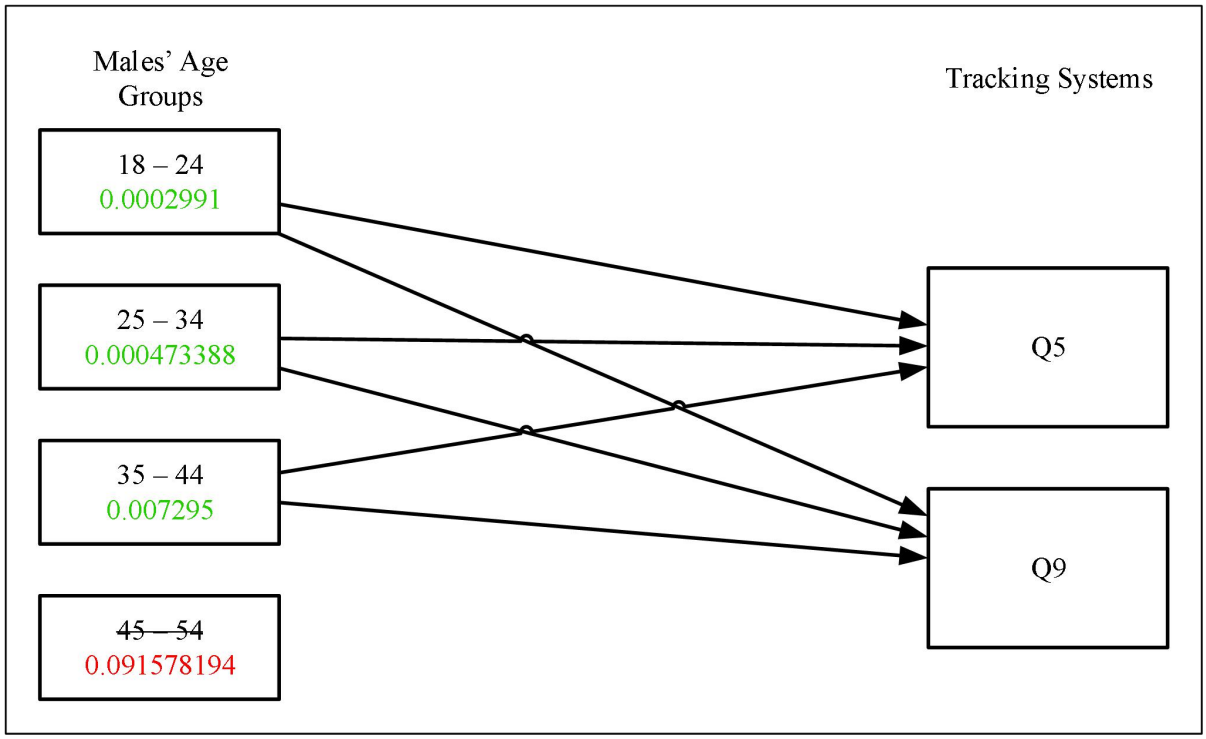

Figure 29. The Significance between the Males' Age Groups and Tracking Systems

As mentioned above, there are two questions, and they are discussed separately. However, the males' group that is not significant is not mentioned or taken into consideration anymore. The table below (see Table 54) provides the average percentages of the whole males' age groups responses for Q5 and Q9. The red highlights present the most percentage.

Table 54

The Results of Tracking Systems for the Males' Groups

Questions No.	SD/D	N	SA/A
Q5	16.68%	26.72%	56.6 %
Q9	22.92%	28.1%	48.98%

Looking at Table 54 indicates that the average of the males' groups responses for Q5 is 56.6% for SA/A, meaning that 56.6% of them believe AI tracking systems would provide better performance for students. Only 16.68% think otherwise as they choose SD/D. 26.72% of the males are not convinced that AI tracking would make such a difference.

Unlike the females' groups, Q9 of males' groups have a definite answer of 48.98%, which is almost half of the males' groups' population, implying that these males' groups would not mind AI tracking systems operating in their OLEs. N of 28.1% and SD/D of 22.92% imply they both are half of the SA/A.

Comparing Tables 53 and 54, as well as Figures 28 and 29, shows that both females and males believe that AI tracking systems would have a positive influence or would provide performance improvements. However, females have safety concerns regarding AI tracking systems operating in their OLEs. Males, on the other hand, would not mind having AI tracking systems.

6.2.3.2 AI technologies and the conceptual framework (TTF)

As depicted in Figure 22, the dependent variable (AI technologies) is connected to the task requirements and tool functionality. The explanation of task requirements and tool functionality can be found in section 6.2.3. There are six AI technologies or applications, speech recognition, RM, Chatbots, E-learning, customisation, and AI tracking systems, discussed in section 3. AI tracking systems can be considered as AI technologies. However, as AI tracking systems are discussed above, this section does not discuss AI tracking systems anymore. The tool functionality of AI technologies is discussed for each technology, along with the task requirements.

The first AI technologies to discuss in this section is OLEs that allow students to create or modify their own visual environments. As Blank et al. (2003) suggested, providing a diverse online environment would create or improve the better learning experience for students (p. 45). Having an option to create a visually pleasing learning environment would attract students to spend more time studying, which is why the visual presentations of the online environment should be taken into considerations (González-Torres et al., 2013, p. 486). These functions would create a better learning experience for students.

However, creating such an array of options and features in an online learning platform would distract students from studying or is hard to achieve. There are many aspects of technological abilities that are needed to perform such complex systems. According to

Dağhan and Akkoyunlu (2016), to create such a platform, many factors should be taken into considerations, such as word processing, spreadsheets, databases, presentations, and communication. The quality of information, system, service, and satisfaction should also be taken into consideration.

Secondly, RM (see section 3.3.1.1). The tool functionality of RM, also known as Recommendation System (Q. Wang et al., 2017), is to provide students with the content or in this case, learning materials. To do that, RM needs to access the history of user activity, or RM should be given a list of requirements to search. RM then will search for appreciating or suitable content for students and present it to students.

Many factors should be taken into considerations when it comes to the task requirements of RM. One of which is the quality of recommendations. The quality, as students see them, should be evaluated rather than evaluating the list of recommendations, meaning that to present the accurate recommendations, the recommendations that students see need to be evaluated. If students ignore most of the recommendations, the system should discard those recommendations in the future (McNee, Riedl, & Konstan, 2006, p. 1100). RM also requires the initial inputs from students when it is used for the first time, as there is no data to evaluate what students' specifications are. Another factor is providing recommendations to stuents' needs or meeting their expectations. RM should provide recommendations based on an individual rather than a group or a collective group (McNee et al., 2006, p. 1100).

Thirdly, AI tutors. The intention of Intelligent Tutoring Systems (ITSs) is to provide one-to-one tutoring by identifying learning styles or methods best suited for students. Doing so would allow students to have control over what they want to learn and set their goals (Luckin, Holmes, Griffiths, & Forcier, 2016, p. 25). As discussed in section 3.3.1, AI tutors would be able to give feedback to students within a shorter time frame. However, there are many limitations to what AI tutors can do. For example, AI tutors would not be able to create learning content, materials, or guidelines for students (Verma, 2018).

Although they would be able to provide results in a really short window, they would not be able to provide a progression or the steps taken to get to the results. One of the limitations of using ITSs is that because the control is in the hands of students, it would be really hard to manage the materials from the teachers (Luckin et al., 2016, p. 25). As AI is making decisions over what to provide and present, there is no set of guidelines or rules.

Fourthly, Chatbots (see section 3.3.1.4). The tool functionality of Chatbots is to communicate with students by giving answers or providing solutions for students. They are mainly used on behalf of humans when providing solutions or performing a certain task. One of the benefits of using Chatbots is that it eliminates the need to have a human available for answering questions. Chatbots can also record the questions and learn from mistakes using AI or machine learning.

The task requirements or the demands from students of Chatbots are based on what students want. Chatbots cannot do everything as students demand. For example, online shopping chatbots would not be able to answer about sports or train schedules. However, chatbots should be able to have a conversational with students based on one particular subject or provide a range of context to discuss (Brandtzaeg & Følstad, 2018, p. 43). Another limitation of Chatbots is that they tend to give unrelated or repeated and boring answers (Yan et al., 2018, p. 149). To have a better experience using Chatbots, Zamora (2017) surveyed by asking participants to rate their experience using the five-point scale. There were four major questions in the study, "ease of starting a conversation, accuracy of understanding the words, quality of results, and relevancy of context" (p. 255). The experience was to have Chatbots that could understand the context in their initial conversations by using open word coding (p. 255). The intention of having Chatbots is to have a computer-based system that can have fluent and seamless conversations with students and providing the necessary services and solutions.

In the fifth place, E-learning (see section 3.3.2.1). The tool functionality of E-learning is to provide a platform that teachers and students can teach and learn. Teachers have the ability to control the quality of materials to present its students ((Nikolić et al., 2018). E-learning gives an opportunity for online student-centred teaching and learning (Rodrigues et al., 2018).

The implementation of E-learning into education opens up the possibility of employing many other AI technologies, such as Chatbots, RM, personalised learning environments, and performance tracking systems. One of the task requirements or demands of E-learning is to provide goals for students by setting up learning objectives, self-regulated learning, and self-tests to evaluate their performance throughout the course (Paechter, Maier, & Macher, 2010, p. 227). Markova, Glazkova, and Zaborova (2017) agreed that providing quality content with the effort from administrators of the system, teachers by learning how to provide better services and following the progress of students (p. 690).

Finally, customisation (see section 3.3.2.1). Customisations is using a group of AI applications (i.e., RM and personalised learning environment by using E-learning) to create a customised recommendation list, online environment with the ability to allow students to create their own visual interface, and setting up their own expectations or goals (Wan & Niu, 2018). This unique ability allows them to spend more time learning and studying.

The table below (see Table 55) provides the list of literature findings for AI technologies discussed above.

Table 55

The Literature Findings of AI Technologies

Literature Review		
AI Technologies	**Task Requirements**	**Tool Functionality**
OLEs	- Word processing - Spreadsheets - Databases - Presentations - Communication	- Provide a better learning experience and environment - Allow modifications from students - Visual presentations
RM	- Quality of recommendations - Evaluation of Recommendations during or after when using RM - Provide an individual based recommendation rather than collective groups	- Provide students with the recommendations - May need to access the history of online activity - Needs initial specifications to provide the recommendations - Search suitable content
AI Tutors	- Keep the guidelines or rules under control - Provide progress or explanations	- Allow to set goals or objectives - Provide a faster feedback - Allow students to create their own learning methods - One-to-one tutoring
Chatbots	- Ability to have conversations - Ease of starting	- Communicate with students - Provide solutions

	conversations - Accuracy of understanding - Quality of results - Relevancy of results	- Record questions
E-learning	- Opens up an opportunity to allow the implementation of RM, Chatbots, personalised learning environment, and performance tracking systems - Set goals, learning objectives, and self-regulated learning - Evaluate the progress - Provide quality content	- Provide a platform - Allow teachers to manipulate the content - Student-centred learning using Internet
Customisation	- Possibility to allow AI technologies to carter for individuals	- Create a recommendation list - Create a personalised learning environment to attract students to spend more time studying and learning

6.2.3.2.1 The significance of AI technologies

Q6, Q7, Q8, and Q10 asked the opinions of respondents regarding AI technologies. The P-values are calculated using the data gathered from the four questions and indicate the significance between the independent and dependent variables. The standard P-value of this research is 0.05. As mentioned in section 5.8, if the P-values of AI technologies are less than 0.05, it means that the independent and dependent variables are significant. If the P-values are more than or above the standard P-value of 0.05, there is no significance between the variables. In this case, the dependent variable is AI technologies, and the independent variables are gender and age groups. Figure 30 presents the relationship between the variables using the P-values.

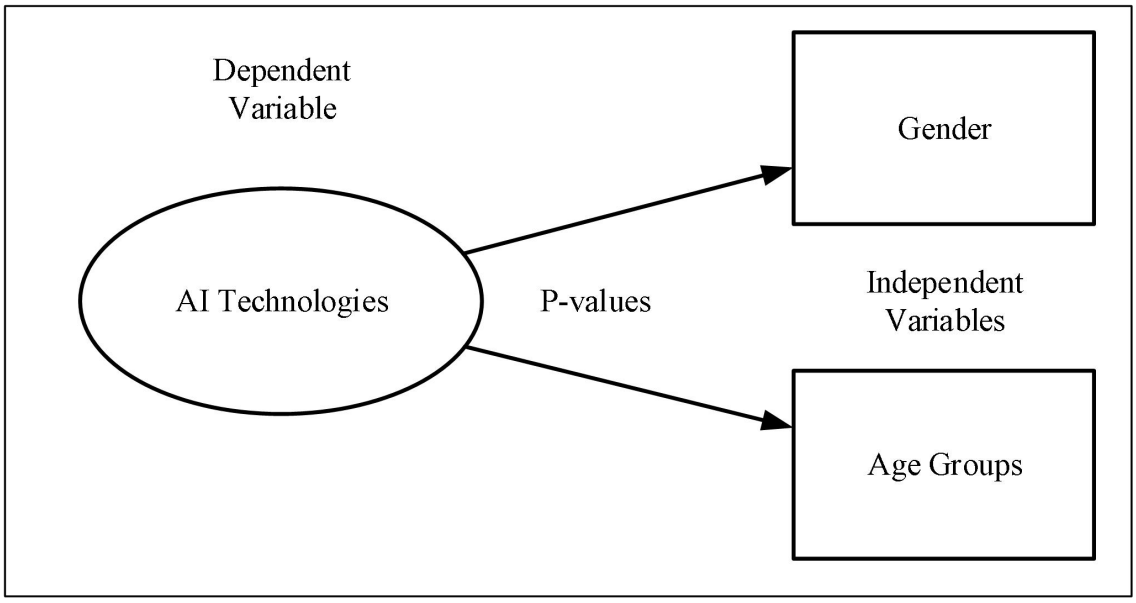

Figure 30. The Relationship between the Independent Variables (Gender and Age Groups) and Dependent Variable (AI Technologies)

6.2.3.2.1.1 The females' age groups and AI technologies

As shown in Table 34 of the section 5.8.4.1.5, all the P-values for females' groups for AI technologies are below or less than the standard P-value of 0.05, meaning that there is a significance between the females' groups and AI technologies. This outcome indicates that AI technologies would have an impact on females' groups. The figure provided below (see Figure 31) indicates the significance between the females' age groups and AI technologies. All the females' age groups are connected to or linked with AI technologies.

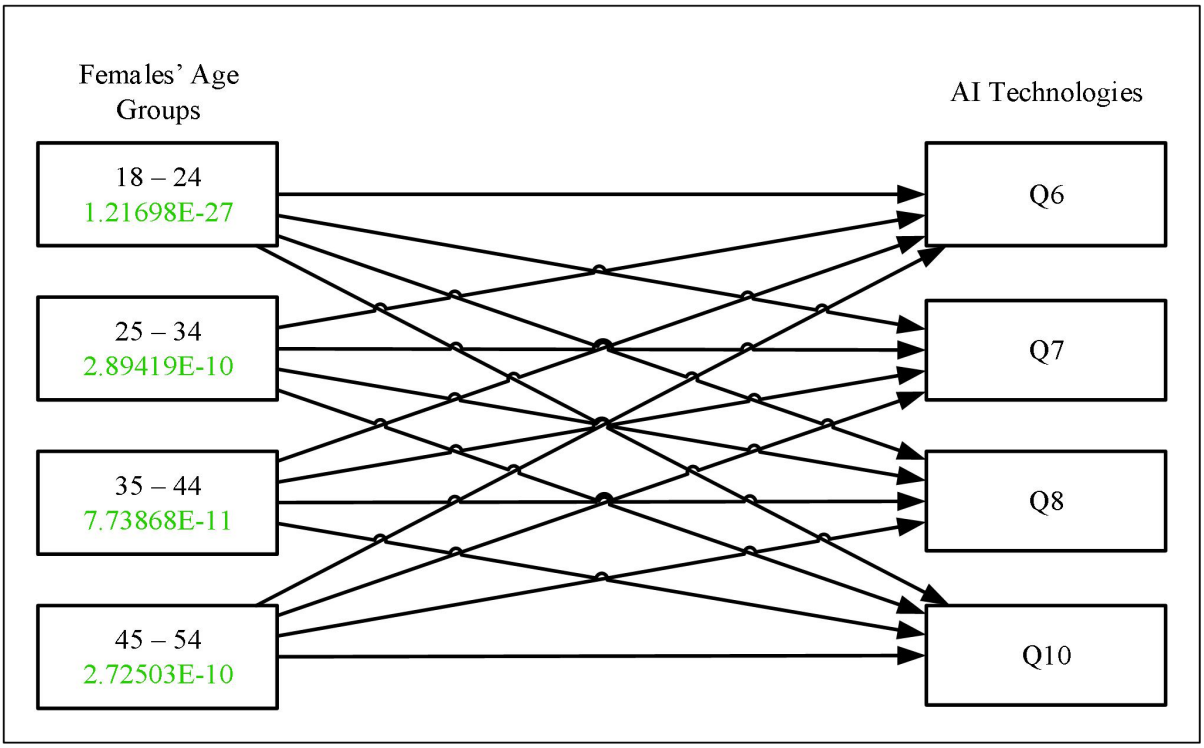

Figure 31. The Significance between the Females' Age Groups and AI Technologies

There are four questions related to AI technologies, as mentioned above. The discussions of each question are presented below. The following table (see Table 56) provides the results in the table format. The red highlights show the biggest percentage.

Table 56

The Results of the Females' Groups for AI technologies

Questions No.	SD/D	N	SA/A
Q6	4.91%	8.37%	86.94%
Q7	1.04%	17.66%	81.30%
Q8	8.15%	14.9%	77%
Q10	10.1%	29.35%	60.6%

The results of Q6 for females' groups used to calculate the average percentages were presented in Table 11, 12, 13, and 14. The average percentage of females' groups who thought that using OLEs, that allowed students to modify to their needs, would improve the performances was 86.94%. 8.37% of them were not sure about LMS; thus, they chose N for Q6. Only 4.91% of them disagreed with the idea of using modifiable LMS, according to Table 56.

Referring to Table 56, the average percentage of Q7 pointed out that 81.30% of the females' groups would like to have RM in education. On the other hand, only 1.04% of them said no to using RM. 17.66% were not sure about RM. Therefore, they answered N for Q7.

The average percentage of the Q8 for females' groups who would use AI tutors was 77%, according to Table 56. 14.9% of them, however, were not interested in AI tutors. Therefore, they answered N for Q8. Only 8.15% refused the idea of using AI tutors in education. Consequently, they chose SD/D for Q8.

For Q10, the average percentage of females' groups who would like to have Chatbots in education was 60.6%. Only 10.1% of them did not want Chatbots as they disagreed with implementing Chatbots. 29.35% did not have a decisive idea of what Chatbots would bring to education; therefore, they answered N for Q10, according to Q10.

Table 56 shows that the females' groups are not against using AI technologies as all of the most percentages are in SA/A. Even though there is a slight drop off in Q8 of AI tutors and Q10 of Chatbots, the general idea of using AI technologies in education is well received among them.

6.2.3.2.1.2 The males' age groups and AI technologies

Table 39 of section 5.8.4.2.6 presents the P-values of the males' groups for AI technologies. Unlike the females' groups, not all the males' groups have the P-values less than the standard P-value of 0.05. The males' age group (25 – 34) has the P-value of 0.213752522, which is bigger or more than 0.05, implying that there is no significance between this group and AI technologies. For that reason, the males' age group (25 – 34) is not considered or included in further discussion. All of the other groups, on the other hand, have the P-values less than 0.05. Figure 32 provides the significance between the males' age groups and AI technologies.

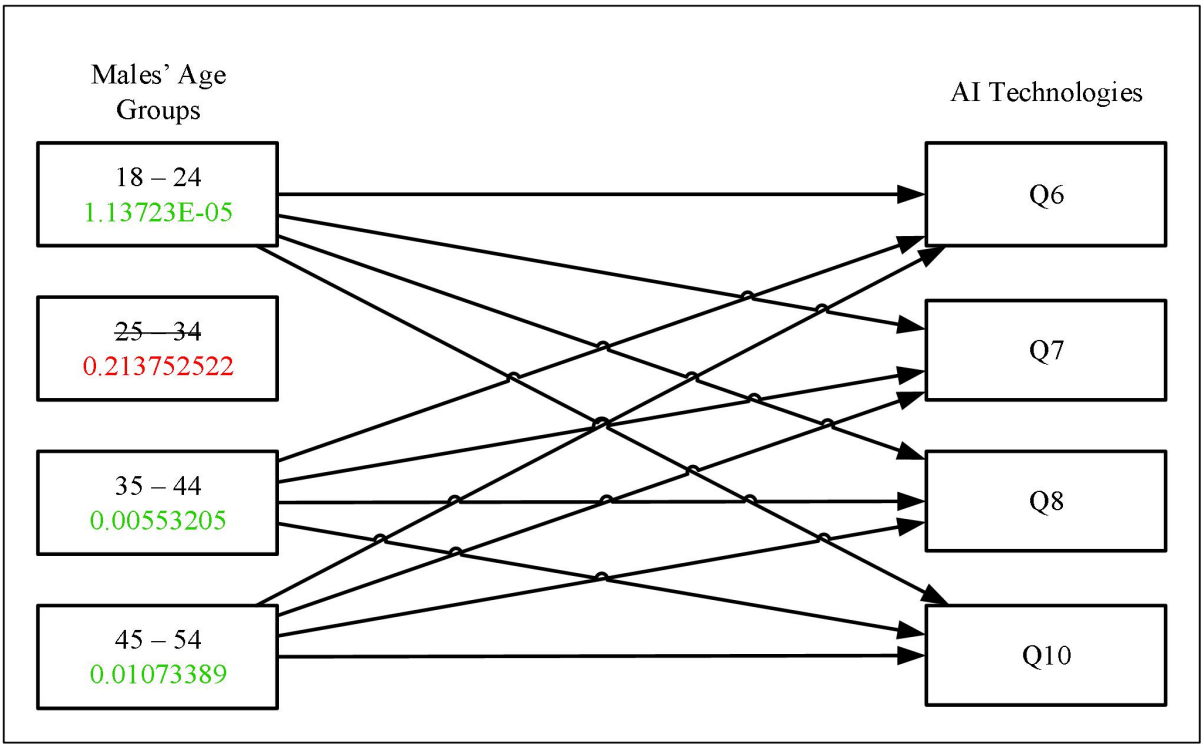

Figure 32. The Significance between the Males' Age Groups and AI Technologies

Table 57 presents the average percentages of the males' groups for AI technologies.

Table 57

The Results of the Males' Groups for AI Technologies

Questions No.	SD/D	N	SA/A
Q6	6.25%	29.67%	63.75%
Q7	10.42%	23.33%	66.25%
Q8	8.33%	21.25%	70.42%
Q10	12.5%	23.75%	63.75%

The results used to calculate the average percentages for Table 57 are presented in Table 15, 17, and 18, as Table 16 of the males' age group (25- 34) is ignored. Q6 of Table 57 shows that 63.75% of them were interested in using OLEs with the ability to modify to students' needs. 29.67% of the males' groups were not convinced with the suggestions of OLEs would improve the performance of students; therefore, they chose N for Q6. 6.25% of them, however, would ignore the LMS or OLEs as they answered SD/D.

According to Table 57, 66.25% of the males' groups would like to have RM in education.23.33%, However, they were sceptical about using RM; therefore, they decided to choose N for Q7. 10.42% refused to use RM as they did not believe that RM would work in education.

As for Q8, 70.42% of those were interested in using AI tutors in education, according to Table 57. 21.25% of them were not keen on having AI tutors as their teachers or examiner as they chose N. Only 8.33% would not like the plan to implement AI tutors in education. Thus, they answered SD/D for Q8.

63.75% of the males' groups would use Chatbots, as shown in Table 57, Q10. 23.75% of them were not sure that Chatbots would help in their education as they chose N for Q10. 12.5% refused to use Chatbots according to Table 57, as they answered SD/D.

Apart from the males' age group (25 – 34), all of the other groups would like to have AI technologies in education, as seen in Table 57. All of the percentages are evenly distributed, meaning that there are no drastic responses for AI technologies from the males' groups.

6.2.3.3 Expectations of AI and the conceptual framework (TTF)

As shown in Figure 22, the dependent variable (the expectations of AI) is connected to or linked with task requirements. There are three main topics within the expectations of AI, speech recognition, identifying learning styles, and security and AI, according to Figure 22.

The reason why the expectations of AI is not connected to tool functionality of the TTF model is as the expectations come from students, in this case, students, they are the demands of tasks or the demands from students. The following sections discuss the three main topics of the expectations of AI. Only speech recognition is connected to tool functionality.

The first is speech recognition (see section 3.4.1). The main task or the main functionality of speech technology is to accept the inputs from students in the form of text or speech. When the user input is received successfully, speech recognition will then consider whether the input is accurate to proceed further. Once the input is obtained successfully, NLG will generate the output in the form of text or speech and deliver it to students (X. Wang & Yuan, 2016, p. 304).

The task requirements or the demands of tasks for speech recognition are as follows:

- the accuracy of the output, meaning that the output should be in the form of natural language that students can understand
- time taken to proceed the task, students expect instant responses
- vocabulary effect, speech recognition should have a large range of vocabulary to understand students
- speaker influences speech recognition, speech recognition systems should be able to understand students who are not native-speakers, children, and elderly, and
- noise effect, speech recognition systems should be able to block out the unnecessary background noises (Alapetite, Boje Andersen, & Hertzum, 2009).

The second is the identification of learning styles or methods. As Chen (2010) mentioned, identifying learning styles is important as individuals have their ways of studying. Another important thing is to adapt to the changes or development of technology used in education (Balakrishnan & Gan, 2016, p. 809). Liew et al. (2015) enforced that providing study materials tailored to students' needs would improve their performances.

There are questionnaires or tests that can identify the type of students (Kothaneth et al., 2012, p. 60). One of the expectations of AIED is to identify the types of students (A. Altugan, 2015b, p. 1159). According to Mantle (2001), there are seven different learning styles. These

styles are discussed in section 3.4.2. Many benefits can come from knowing the types of students (Švarcová & Jelínková, 2016). Cultural differences also affect the types of students and methods to apply to (Altugan, 2015b, p. 1161). For teachers to support students, they also have to know the differences and similarities between students (Švarcová & Jelínková, 2016).

The last topic is security and AI. As discussed in section 3.4.3, there are many security concerns around AI as AI needs lots of information or data to perform a certain task (i.e., to identify the types of students, students might have to give access to almost everything in terms of online learning environment) (Mohamad & Tasir, 2013, p. 320). Many factors should be taken into considerations when it comes to using AI in education (Keskinbora, 2019). Trust should be one of the critical parts of using AIED (Langer et al., 2019, p. 231). Keskinbora (2019) mentioned that AI should be transparent and should ask for permission from students before accessing data from students. One of the main aspects of using AIED is that it should be able to guarantee the safety of students (Langer et al., 2019, p. 231). Table 58 provides the literature findings of the expectations of AI in table format.

Table 58

The Literature Findings of the Expectations of AI

Literature Review		
AI Technologies	**Task Requirements**	**Tool Functionality**
Speech Recognition	- Accuracy of the output - Time taken to process - Vocabulary effect - Speaker influences - Noise effect	- Accepting user input - Evaluate the input - Generate the output - Deliver the output
Identifying Learning Styles	- Identify individuals' learning styles - Provide improvement on the performance of students - Take cultural differences into considerations - Know the differences and similarities of students	
Security and AI	- Needs lots of data - Trust in AI	

	- Transparency - Consent from students to give access - Safety of students	
Expectations of AI	- AI to be a teammate - Seamless integration - Ability to have a conversation	

6.2.3.3.1 The significance of the expectations of AI

Q11, Q12, and Q13 asked the expectations of AI. The P-values are calculated using the data gathered from the questions. The P-values indicate the significance between the independent and dependent variables. If the P-value is more than or bigger than the standard P-value of 0.05, the independent and dependent variables are significant. If the P-value is more than the standard P-value, there is no significance between the variables. Figure 33 presents the relationship between the independent and dependent variables; in this case, the gender, age groups, and the expectations of AI.

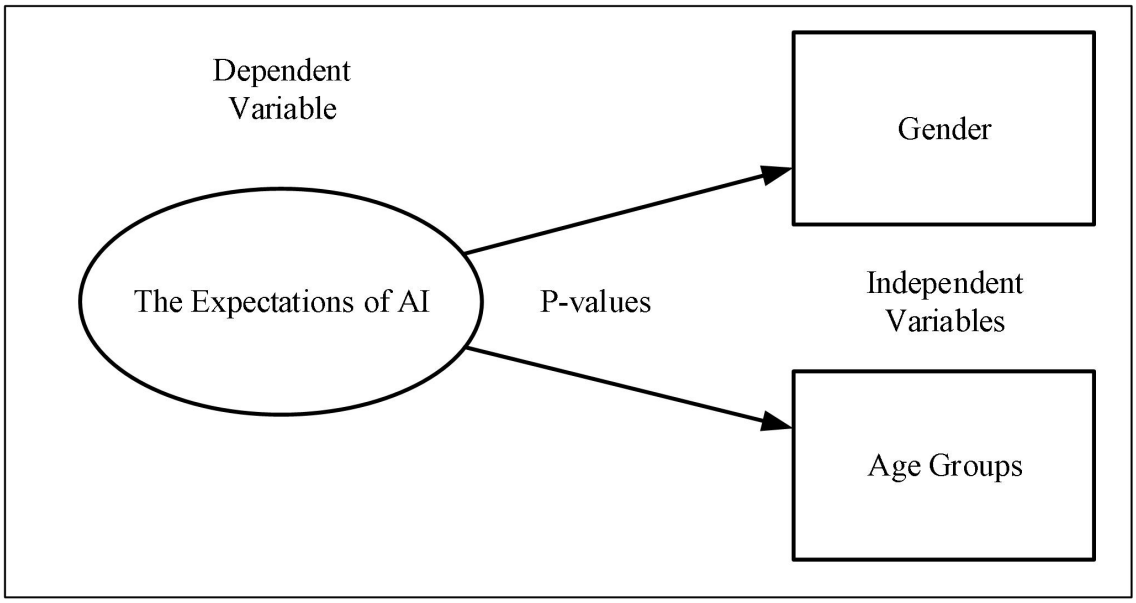

Figure 33. The Relationship between the Dependent Variable (the Expectations of AI) and the Independent Variables (Gender and Age Groups)

6.2.3.3.1.1 The females' age groups and the expectations of AI

Table 44 presented the P-values of the females' age groups for the expectations of AI. All the P-values are less or smaller than the standard P-value, implying that there is a significance between the females' groups and the expectations of AI. This means that they would expect AI to have such features. Figure 34 presents the significance between the females' age groups and the expectations of AI.

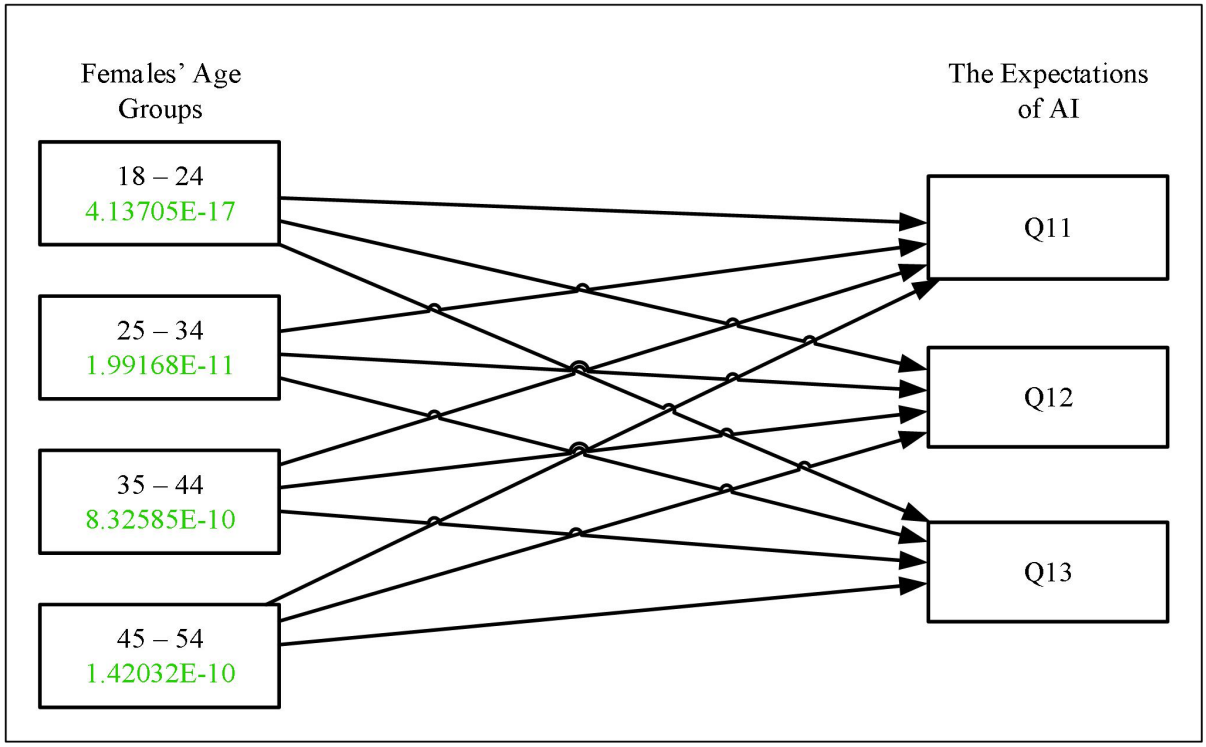

Figure 34. The Significance between the Females' Age Groups and the Expectations of AI

The three related questions are discussed one by one in the following sections. Table 59 displays the results of the average percentages of the females' age groups for the expectations of AI using Tables 11, 12, 13, and 14. The red highlights present the most percentages.

Table 59

The Results of the Females' Age Groups for the Expectations of AI

Questions No.	SD/D	N	SA/A
Q11	5.21%	14.1%	80.69%
Q12	7.11%	27.07%	65.82%
Q13	8.15%	16.32%	75.53%

According to Table 59, the average percentage of females who would use AI if AI is proven to be effective is 80.69%. Only 5.21% would reject using AI. 14.1%, however, would not give a decisive answer, according to Table 59.

Q12 was about asking the opinions of respondents regarding AI. 65.82% believed that AI technologies would provide a better learning experience for students. 27.07% did not have a clear answer for Q12, according to Table 59. Only 7.11% believed that AI would not make any difference in education as they answered SD/D.

The last question of the survey was Q13, and it was about asking whether or not they would use these AI technologies if available to them. 75.53% would use them, as seen in Table 59. Only 8.15% would not use them even if they offered performance improvements for them. 16.32% was not sure about AI as they answered N for Q13.

Table 59 indicates that the females' groups are willing to use AI and expect them to perform. All of the red highlights are in SA/A. Even though there are issues with many of these technologies, however, if AI can promise the performance, the indications point that they would not mind using AIED.

6.2.3.3.1.2 The males' age groups and the expectations of AI

Table 49 in section 5.8.5.2.5 provides the P-values of the males' age groups for the expectations of AI. As seen in Table 49, the males' age group (25 – 34) has the P-value larger than the standard P-value of 0.05, indicating that this group and the expectations of AI are not significant. The data of the males' age group (25 – 34) is ignored from now on. All the other groups have the P-values less than 0.05. Figure 35 provides the link between the males' age groups and the expectations of AI.

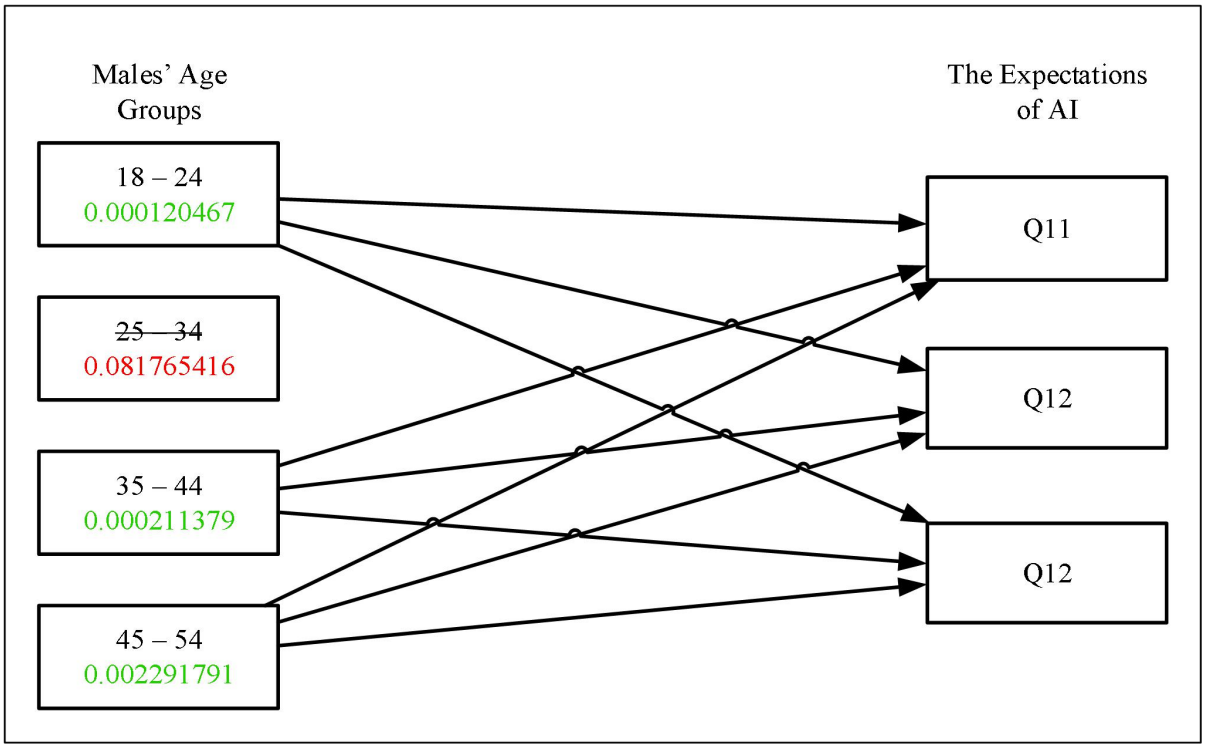

Figure 35. The Significance between the Males' Age Groups and the Expectations of AI

As mentioned above, the three related questions are discussed below. The following table (see Table 60) shows the average percentage of the males' age groups for the expectations of AI. The red highlights indicate the largest percentage.

Table 60

The Results of the Males' Age Groups for the Expectations of AI

Questions No.	SD/D	N	SA/A
Q11	10.42%	19.58%	70%
Q12	2.08%	47.08%	50.83%
Q13	2.08%	15%	82.92%

As shown in Table 60, 70% of the males' groups would like to use AI if it was proven to have a positive impact on education. 10.42%, on the other hand, would not use AI even if they guarantee to offer better performance. 19.58% were not sure about AI could offer such promises; thus, answered N for Q11.

For Q12, 50.83% of the males' groups thought that these AI technologies would provide a better learning experience for students. 47.08% were not sure about AI to have such an impact and answered N, as depicted in Table 60. Only 2.08% chose SD/D as they completely disagreed that AI could give such experience.

Even though only half of the males' groups thought AI would have such impact, 82.92%, however, would like to use AI technologies if they were available to them. 15% was not sure about using them; therefore, they answered N for Q13, as seen in Table 60. The same percentage of 2.08 for Q12 answered SD/D for Q13, as the percentage is 2.08. They would not use AI technologies.

When looking at Tables 59 and 60, the one common factor is that Q12 has the least percentages of SA/A out of the three questions. The males' age groups had even less percentage for Q12, as only half of them agreed that AI would provide a better learning experience. This shows that even if they would like to use AI, they were not convinced that AI would provide such experience for students.

6.2.4 The outcome of the comparisons and the significance

As seen in Table 50, when comparing the gender with the individual performance, all the females' groups indicate that they would use AI if they can get better performance. Males' groups, however, were not keen on using AI even if they can benefit from using AI compared to the females' groups.

Although males' groups would not use AI to improve their performances, when asked about using AI technologies if they were available to them, with even only one-third of the respondents were males, males' groups said they would like to use AI technologies more than the females' groups, according to Table 51.

As mentioned in section 6.2.1.2.1, there is no link between age groups and individual performance, although the females' age groups of 34 – 44 and 45 – 54 have slightly higher percentages regarding actual tool use than the other groups. Even with the highest number of participants, the females' age group (18 – 24) has the lowest percentage amongst the females' age groups, as shown in Table 50.

As mention in section 6.2.2.4, there is a consistent pattern for Q6, Q7, Q8, Q11, and Q13 from females' groups. However, only Q11 and Q13 have a consistent pattern for males' groups. 80.7% of the females' groups will use AI if it is proven to be effective. Only 68.68% of males' groups would use AI. However, 76.9% of the males' groups would use AI if available to them. 75.53%, which is less than the percentage of males' groups for Q13, of the females' groups would use AI technologies if available.

Section 6.2.3.1.1.2 reveals that both females' and males' groups thought that AI tracking systems would have a positive impact. Females' groups, however, have security concerns around AI.

In section 6.2.3.2.1.1, the females' groups showed that they would use AI technologies. RM and OLEs are more preferred AI technologies when compared to Chatbots and AI tutors.

For section 6.2.3.2.1.2, the males' age group (25 – 34) is not significant with AI technologies as the P-value is larger than the standard P-value. Unlike the females' groups, the percentages of the males' age groups for AI technologies are evenly distributed. However, they would use Chatbots more than the other ones as Chatbots has the most percentage of 70.42%.

Both the females' age groups and males' age groups, with the exception of the males' age group (25 – 34) as this group has the P-value bigger than 0.05, would use AI, although both genders have low expectations regarding the fact that AI would provide a better learning experience for students.

The next section discusses the hypotheses and RQs using the data from Chapter 5 and findings from Chapter 6.

6.3 Hypotheses testing and RQs

This section discusses and tests the hypotheses. There are six hypotheses to test in the research, as mentioned in section 2.3. Each hypothesis is discussed using literature findings and findings from data analysis and discussion. After the discussions of hypotheses, the relationships between the hypotheses and RQs are discussed. The first hypothesis is H1.

H1: Students who use AI will have better performance.

As H1 is about students, in this case, the students, and the performance of students, the independent variables are the appropriate variables to test the H1. Figure 36 shows the links between the independent variables and H1.

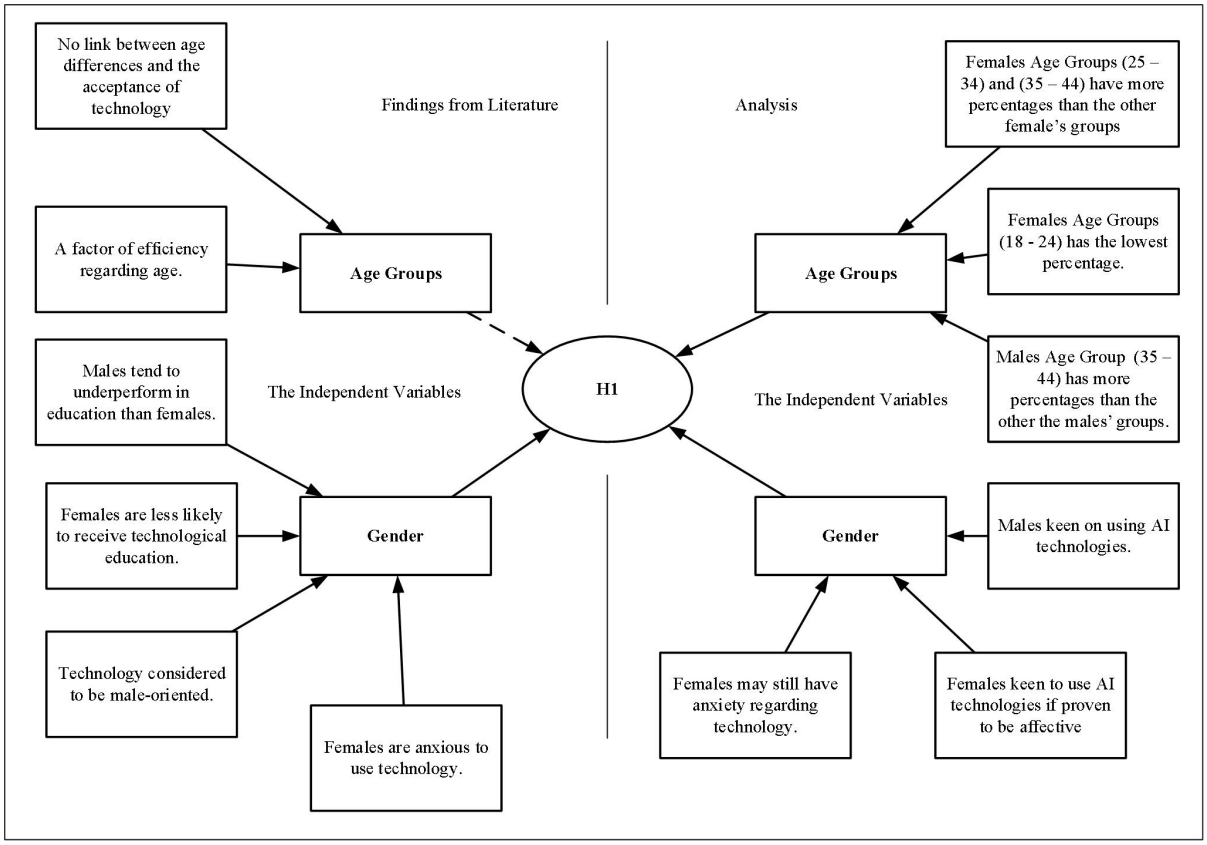

Figure 36. The Relationship between the Independent Variables and the Findings from Literature and Analysis

According to Chung et al. (2010), there is no link between the age differences and the acceptance of technology, as shown in Figure 36. However, there is a factor of efficiency when it comes to using technology. Dabaj (2009), on the other hand, found out that gender and age had effective teaching and learning (p. 4).

Figure 36 shows that gender affects performance. As stated in 6.2.1.1.2, females tend to receive less education when it comes to technology as the field of technology is considered to be male-oriented (Huffman et al., 2013, p. 1784). Sanders (2005) pointed out that the fact that there was a lack of female role models had an impact on females being less interested in technology. Comparing the time spent by the computer science faculties reveals that males received more time than the females (Sanders, 2005). There was also an unequal treatment from tutors when it came to technology, as males tend to have better treatments. These factors contribute to the fact that males were likely to have more experience in technology (Sanders, 2005). The negative effect of the fact was that females were more anxious to use technology (Sanders, 2005)

Findings from Analysis (Chapter 5), discussion (Chapter 6), and Figure 36 suggest that females and males agree that AI would improve their performances (see section 6.2.1.2.1). However, the females' age groups (25 – 34) and (35 – 44) have more percentages that would use AI (see Table 50). The females' age group (18 – 24) has the lowest percentage among the females' groups, according to Table 50. Males' group (25 – 34) has the lowest percentage among the males' groups when asked about using AI technologies if they are available (see Table 51). Males' age group (35 – 44), however, has the highest percentage among the males; age groups. The pattern shows that the age group (35 – 44) of both genders would use AI technologies more than anyone. This finding indicates that the age groups have an effect on H1.

Gender also has an impact on H1, according to Figure 36. Section 6.2.1.1.2 shows out that even with the higher females' respondent number, there may be a case of anxiety for the females' groups as males' groups have a higher percentage that would use AI technologies. Females' groups, however, would use AI technologies if proven to be effective, as discussed in section 6.2.1.2.2.

The discussion in the above sections and Figure 36 point out that there are similarities and differences between the findings from literature and analysis. Findings from the literature show that there is no link between age differences and the acceptance of the technology. On the contrary, the findings of the analysis reveal that the females' age groups (35 – 44) and (45 – 54), as well as the males' age group (35 – 44), would like to use AI technologies more than the other groups. The findings from the literature point out that males tend to underperform in education. The findings from analysis also find a similar result as males would not use AI technologies even if it is proven to be effective. Another finding from

analysis is that females' groups would use AI technologies if they are proven to be effective but would not use or try out AI technologies if available to them when compared to males' groups. Males' groups, however, would use AI technologies to try out. They do not intend to use AI technologies to improve their performances compared to the females' groups.

Figure 37 provides the relationships between AI technologies and H1. The tool functionalities of AI technologies are presented in Figure 37 along with the percentages of the females' and males' groups who would use them.

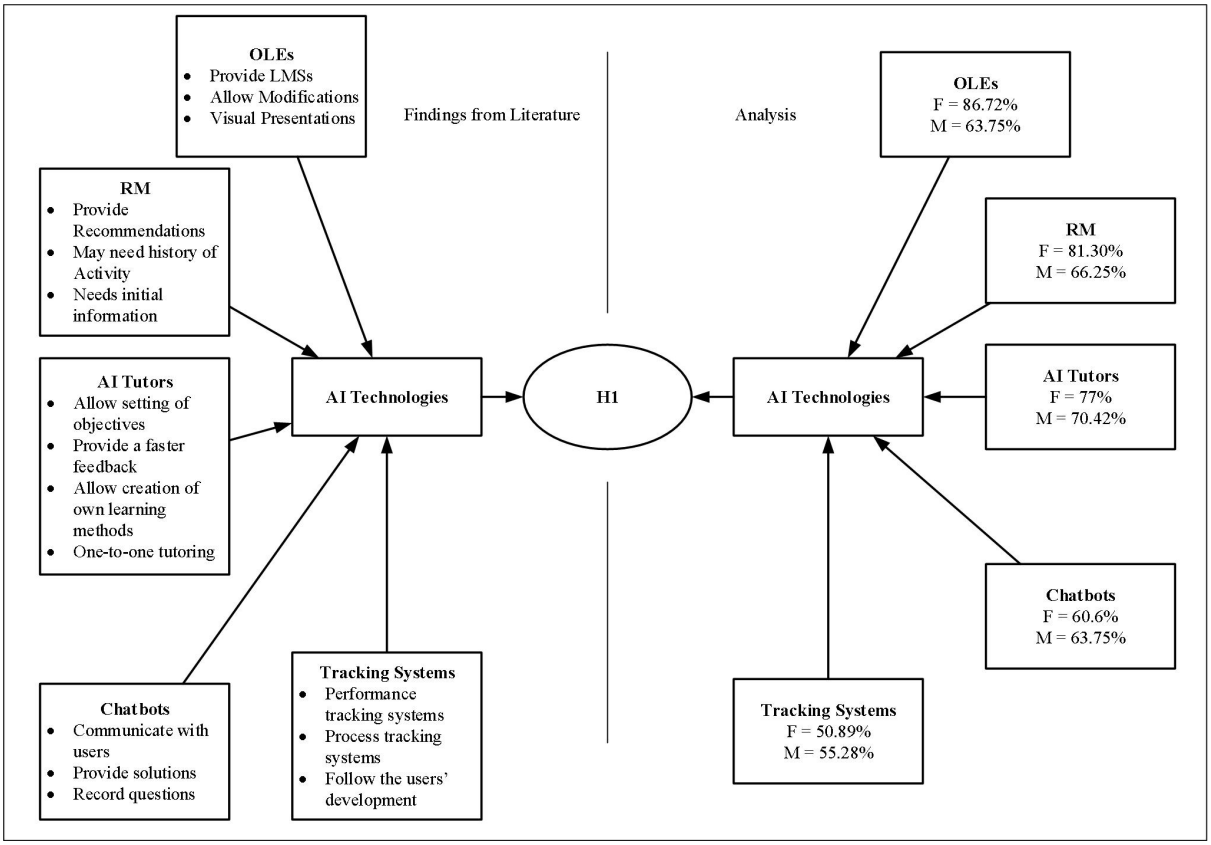

Figure 37. The Relationships between AI Technologies and Responses of Participants

AI technologies also have an impact on H1. As Figure 37 suggests, there are AI technologies, such as LMSs, OLEs, RM, Chatbots, AI tutors, E-learning, and customisation systems. These AI technologies promise to provide a better learning experience for students. Analysis findings of Figure 37 show that there are technologies that are more appealing to respondents than the other ones. The functionalities of OLEs are to provide LMSs for students by allowing modifications and having visually pleasing online environments. The tool functionalities of RM found in literature findings are to allow students to have recommendations, provide faster feedback, and RM also needs initial information or data to consider what materials to recommend, as discussed in section 6.2.3.2.

The functions of AI tutors, according to the literature findings, are to allow the setting of objectives or goals. One of the main functions of AI is to provide feedback to students. Another function is to provide students with their own learning methods. One of the main benefits of using AI tutors is that students get to have one-to-one tutoring, as discussed in section 6.2.3.2.

According to section 6.2.3.2 and section 3.3.1.4, Chatbots can communicate with students, provide solutions, and record questions from students. Compared to other AI technologies, the respondents who would like to use Chatbots are less than the others. The literature findings of section 6.2.3.1 show that performance tracking systems are to track students' performance during a test and throughout their courses. The process tracking systems are to follow the development of students.

For OLEs, 86.72% of females' groups would like to have them and 63.75% of males' groups, with the exception the males' age group (25 – 34) as there is no significance between AI technologies and this group, according to Table 39, would like to have OLEs in education. Literature findings of Figure 37 show that OLEs can provide a better LMSs, allow modifications by students, and have visually pleasing presentations, according to section 6.2.3.2.

81.30% of the females' groups would like to use RM. Only 66.25% of the males' groups, without the males' age group (25 – 34), would use RM.

77% of the females' groups would like to have AI tutors in educations. 70.42% of the males' groups, not including the males' age group (25 – 34), also would like to have AI tutors in education.

Only 60.6% of the females' groups would use Chatbots. 63.75% of the males' groups (the males' age group (25 – 34) not included) would use Chatbots.

Tracking systems have the least percentages according to Figure 37. 50.89% of the females' groups and 55.28% of the males' groups (not including the males' age group (45 – 54)) would use tracking systems.

Out of these AI technologies, the females' groups would like to use RM and OLEs, as discussed in section 6.2.4. Males' groups would use AI tutors the most out of these AI technologies. The findings suggest that H1 can be concluded as approved, or individuals who use AI will have better performance. The next section discusses and finds out the results for H2.

H2: Students who do not use AI will have better performance.

H2 is the opposite of the H1. H2 is to find out the performance of individuals who would not use AI. Figure 38 provides the relationships between the independent variables and H2.

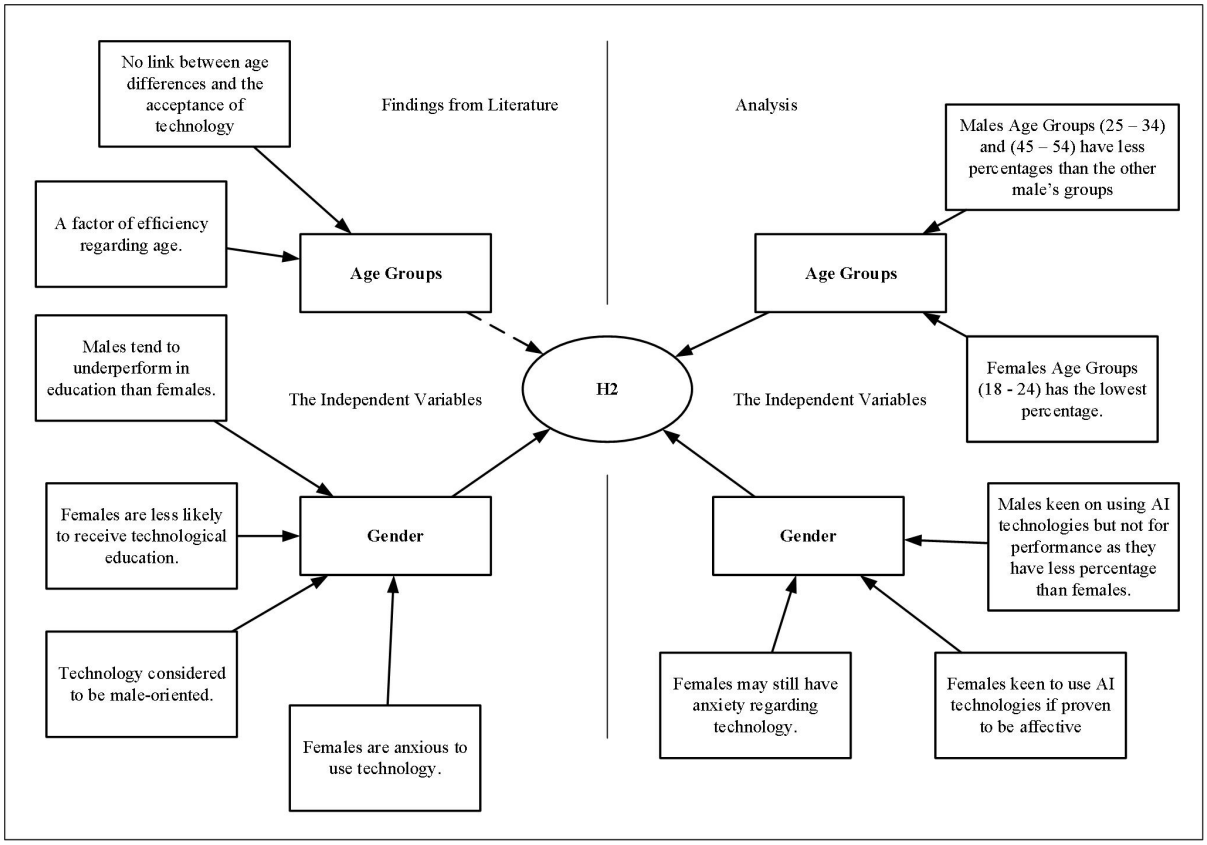

Figure 38. The Relationships between the Independent Variables and the Findings from Literature and Analysis

According to Figure 38 and Chung et al. (2010), there is no link between age differences and the acceptance of the technology. However, H1 found out that, in fact, there is a link between the age differences and the use of AI. There is also a factor of efficiency regarding age, as discussed in H1.

H2 is to test the fact that AI is not a complete necessity to improve the performance of students (see section 4.3.2). Analysis of age groups shows that the males' age groups (25 – 34) and (45 – 54) have fewer percentages than the other males' groups (see Table 50). These two males' groups (25 – 34) and (45 – 54) do not entirely believe or trust that AI would improve the performance of students when compared to other groups. Females' age group (18 – 24) also has less percentage than the other females' groups as they have doubts about AI having such influences on students (see Table 50). Looking at the pattern of the females' age groups

(see Table 50) suggests that younger females' age between (18 – 24) have less trust in AI than the other groups. As for males' age groups, there is no consistent pattern. This finding shows that females still have anxiety towards using AI or technology in general.

When looking at the effect of gender on AI, according to Figure 38, the findings from the literature show that males tend to underperform in education, as discussed in H1. Females are more anxious to use technology, according to (Sanders, 2005). These findings are similar to the findings from the analysis as males' groups are keen on trying the new technology; in this case, AI (see section 6.2.1.1.2). The percentage of females (80.69%) that would use AI if it is proven to be effective is more than males' groups (70%) (see Table 59 and Table 60). Females, however, when asked about trying out AI technology, 75.53% indicated that they would use AI technology, which was less than males' groups of 76.9% even though females' respondents were more than two-thirds of the males' respondents. One of the reasons why females' groups are not willing to try new technology is that females tend to receive or given less time regarding technological education (Huffman et al., 2013, p. 1784). This factor leads to females having anxiety towards technology, meaning that they may not use AI technology if there is no proof of AI having a positive impact. Although males receive more time regarding technology in education, the finding of males not willing to use AI if proven to be affected means that they underperform when compared to females, according to Figure 38.

Figure 39 provides the relationships between AI technologies and H2. The task requirements of AI technologies are looked at in H2 and compared it against the respondents' perspectives.

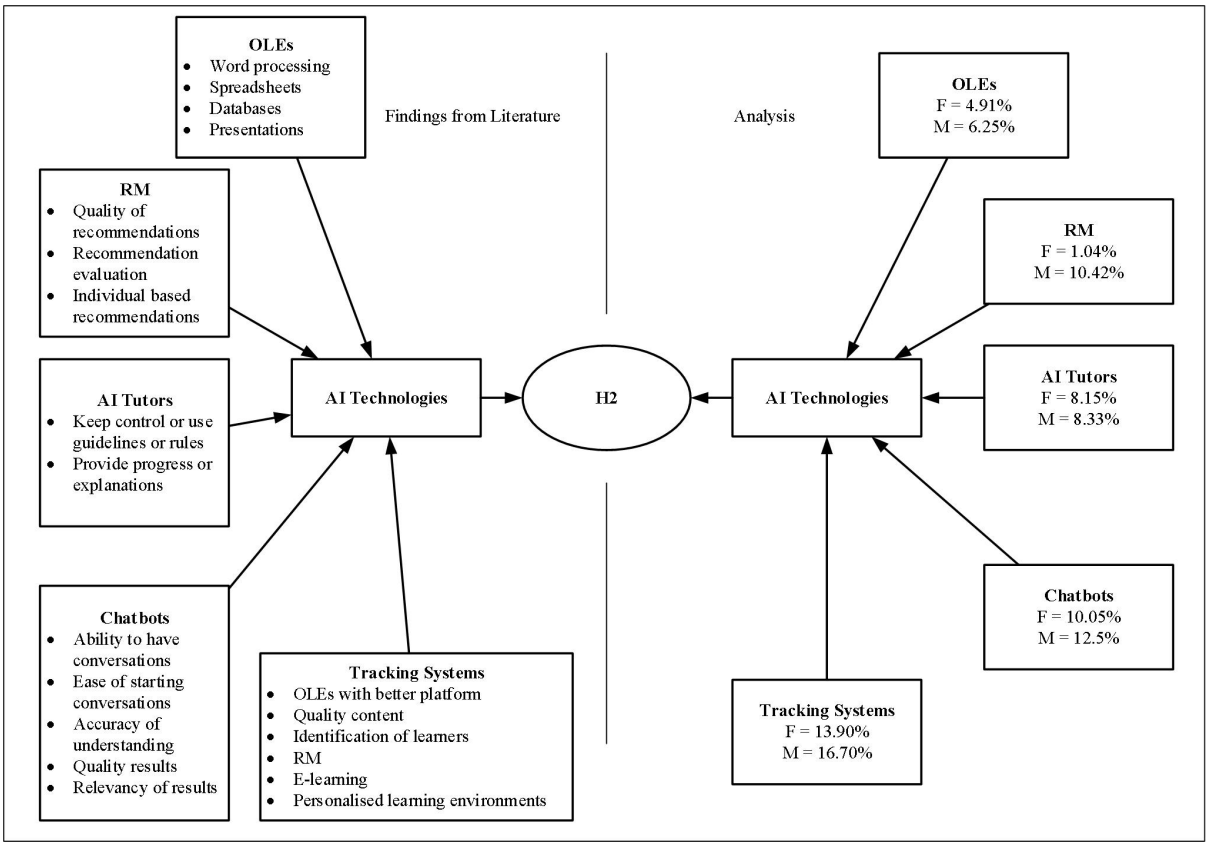

Figure 39. The Relationships between AI Technologies and the Responses of Participants

The tool functionalities, or the capabilities of AI technologies are discussed in H1. The section discusses the task requirements or the expectations of AI with the findings from literature and analysis to test H2. The data or average percentages used in Figure 39 can be found in Table 11, 12, 13, 14, 15, 16, 17, and 18.

Figure 39 provides that there are five AI technologies or applications used to find the expectations in this research. The first one is OLEs. There are many expectations regarding OLEs. The four suggestions show in Figure 39 can be found in Table 55. Work processing, spreadsheets, databases, and presentations should be included, according to Dağhan and Akkoyunlu (2016).

The expectations of RM, according to Figure 39 and section 6.2.3.2, are the quality of recommendations, recommendation evaluation, and individual-based recommendations. The quality of recommendations means that the recommendations should reflect what they are studying or what they have searched or requested before (McNee et al., 2006, p. 1100). The

recommendation evaluation means that the process of evaluation should be in place to provide the best recommendation lists. The recommendations should base on individuals rather than a group of people or a region (McNee et al., 2006, p. 1100).

The third is AI tutors. As Luckin et al. (2016) suggested, the intention of AI tutors is to allow students to have one-to-one tutoring with having control over what they want to learn and achieve. Another factor is that AI tutors may not be able to show or provide the progression of problems or steps taken to get to the results as they cannot provide guidelines or rules (Luckin et al., 2016, p. 25).

Chatbots are the fourth AI applications of Figure 39. One of the five requirements of Chatbots is to have conversations with students (see section 6.2.3.2). There should be a list of contexts that Chatbots should be able to discuss and have conversations with students (Brandtzaeg & Følstad, 2018, p. 43). Another expectation is to start a conversation with ease, meaning that they should be able to figure out what a user is trying to find or discuss (Zamora, 2017). As there are many students and many instances of use cases, meaning that students may use Chatbots for different reasons, Chatbots should be able to understand different students accurately. For that reason, the accuracy of understanding is one of the expectations of students (Zamora, 2017). Another two expectations are related to each other. The quality and relevancy of the results should meet the expectations of the user (Zamora, 2017). Chatbots should be able to return content or answers related to what students asked or requested.

The last AI technology is tracking systems. As tracking systems are a part of a complex system, implementing such complex systems requires the platform such as E-learning what is a platform to achieve these AI technologies mentioned above and Customisation or a personalised learning environment is to allow students to create their own online environments by using these AI technologies. The aim of such a complex system is to provide students with quality content by identifying the type of students, and recommending what content to study using RM. However, creating such a complex system is almost impossible due to hardware limitations. On the other hand, there are respondents who do want tracking systems.

As there are only 4.91% of females and 6.25% of males who would not use the OLEs, these expectations should be taken into considerations along with the quality of information, system, and services. There are only 1.04% and 10.42% of females' and males' groups,

respectively, who would refuse to use RM. This finding implies that the task requirements of RM should be in place to fulfil these expectations.

8.15% of females' groups and 8.33% of males' groups said they would not use AI tutors as they do not believe that AI tutors can meet their expectations according to Figure 39. The findings from analysis suggest that 10.05% of females and 12.5% of males would not use Chatbots, as shown in Figure 39. 13.90% of females and 16.70% of males would not use the tracking systems.

The findings show that H2 can be concluded as not approved by the data set, as there are not many respondents who would oppose using AI technologies in education. Although males may underperform compared to females, females may have anxiety towards technology. There is no significant statistic that shows otherwise.

H3: Students will not feel safe using AI online tracking systems.

H3 is about the safety and security of students; in this case, the students are students. H3 tests the task requirements and tool functionalities of tracking systems with the security concerns against the students; in this case, the respondents. Figure 40 provides the relationships between the tracking systems and the independent variables.

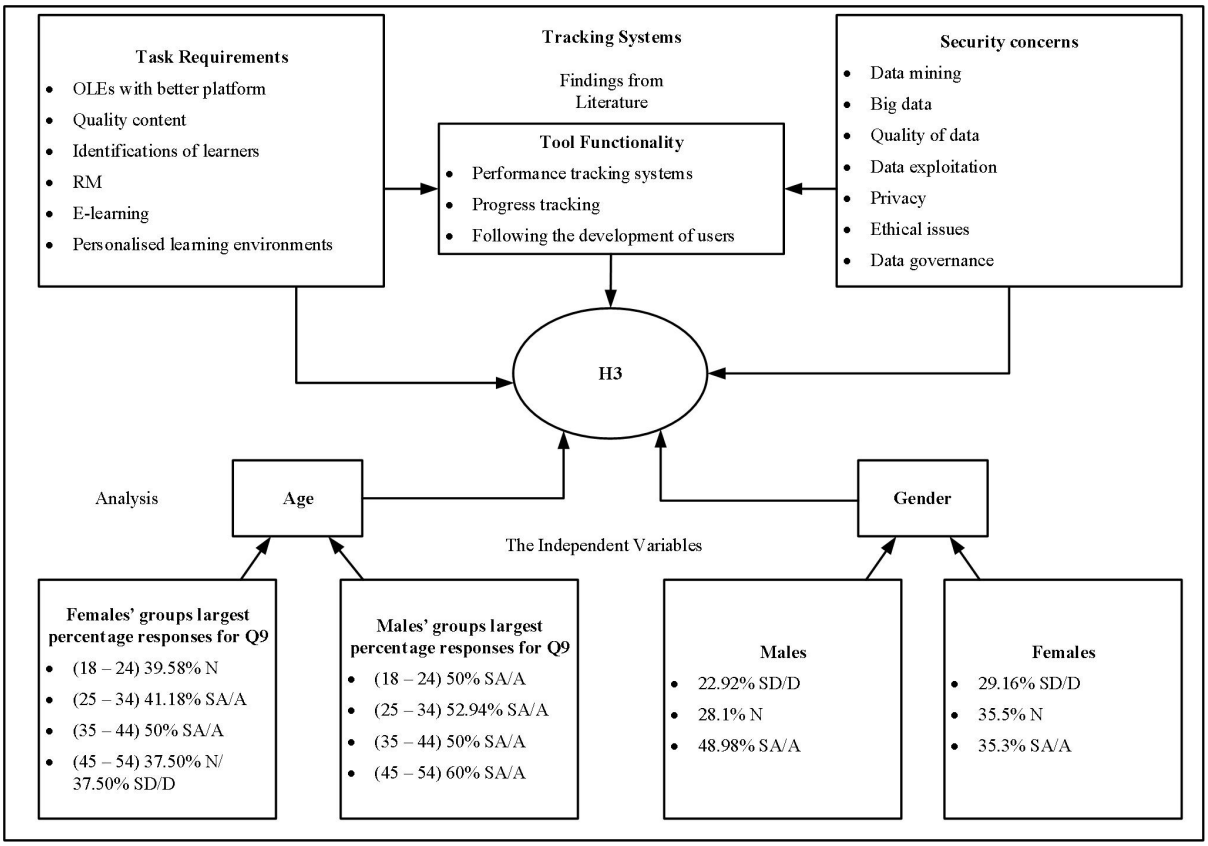

Figure 40. The Relationships between H3, Tracking Systems and the Independent Variables

As illustrated in Figure 40, there are three areas concerning the tracking systems from the literature review, task requirements, tool functionality, and security concerns. Three areas are discussed in the above section (see H1) and in the following sections.

The first area is the tool functionality or the capabilities of the tracking systems. There are three main functions of the tracking systems, the performance tracking systems, the progress tracking systems, and the development of students. The performance tracking systems are to measure or evaluate students' performance during tests or overall performance (see section 6.2.3.1). The second is the progress tracking systems. These systems are to follow the progression of a student throughout a course and provide them with the necessary information to perform better (see section 6.2.3.1). The last area is the combination of the two

tracking systems to follow the students' development throughout their undergraduate or postgraduate process to ensure that they do their best to achieve their goals.

The task requirements of the tracking systems are discussed in H2 and section 6.2.3.1. The main requirement of the tracking systems is to support OLEs by combining RM, E-learning, providing quality content, identifying the type of students, and allowing students to create their own online environments.

There are many security concerns around AI tracking systems. According to Figure 40, there are seven major concerns. The first one is data mining. As discussed in section 3.4.3, "data mining is advantageous in the field of education, especially when examining student's learning behaviour in an OLE" (Mohamad & Tasir, 2013). A lot of data needs to be processed and stored to understand the behaviours of students. Collecting a huge amount of data raises the concern of privacy and big data (Talha et al., 2019, p. 916). Another issue is to make sure that the data collected is useable and valuable.

As mentioned in section 3.4.3, there is not many research on big data and security. Data governance should be in place to control the data exploitation and manage the quality of data (Al-Ruithe & Benkhelifa, 2018). The privacy and security concerns are still a big issue for AI, as AI needs a lot of data. Storing or collecting a large amount of data would create distrust from students. The ethical considerations should be taken seriously to collect and process data of students (Keskinbora, 2019). Langer et al. (2019) mentioned that there should be a way to create trust between students and new technology (i.e., AI) (p. 231).

Q9 of the survey conducted was about asking whether respondents would feel safe using AI tracking systems. As there are two independent variables, this section discusses the responses for Q9 using gender and age groups.

The first one is gender. Looking at the average percentages of the females' and males' groups shows that females' groups' responses are evenly spread out while males' groups' responses for SA/A is decisive as 48.98% would not mind having AI tracking systems. This shows that even though females' groups would like to use AI technologies, as mentioned in H1, they still are concerned about having AI tracking systems in their OLEs.

The above conclusion represents that females' groups are not willing to have AI tracking systems. More analysis of females' and males' age groups would reveal which age groups are more cautious about AI tracking systems. Looking at Figure 40 points out that the females' age groups (18 – 24) and (45 – 54) have the highest percentages for N with 39.58% and 37.50%, respectively. The females' age group (45 – 54) also has the same percentage of

37.50% for SD/D, meaning that this group is the most cautious group followed by the females' age group (18 – 24). The females' age group (35 – 44) has the highest percentage of 50% SA/A for AI tracking systems.

On the other hand, the males' age groups all have the highest percentage of SA/A for Q9, meaning that all of them agree to have AI tracking systems in education, according to Figure 40.

H3 can be concluded as two different findings, females and males. Females' groups would not feel safe using AI tracking systems; however, the males' groups would feel safe using AI tracking systems.

H4: AI is a useful tool for students.

H4 is to test that AI is a tool useful for students, and students can use AI in everyday life without causing any harm. H4 looks at the tool functionalities of AI technologies and compares it against the responses from participants. Figure 41 provides the relationships between H4, AI technologies, and the independent variables.

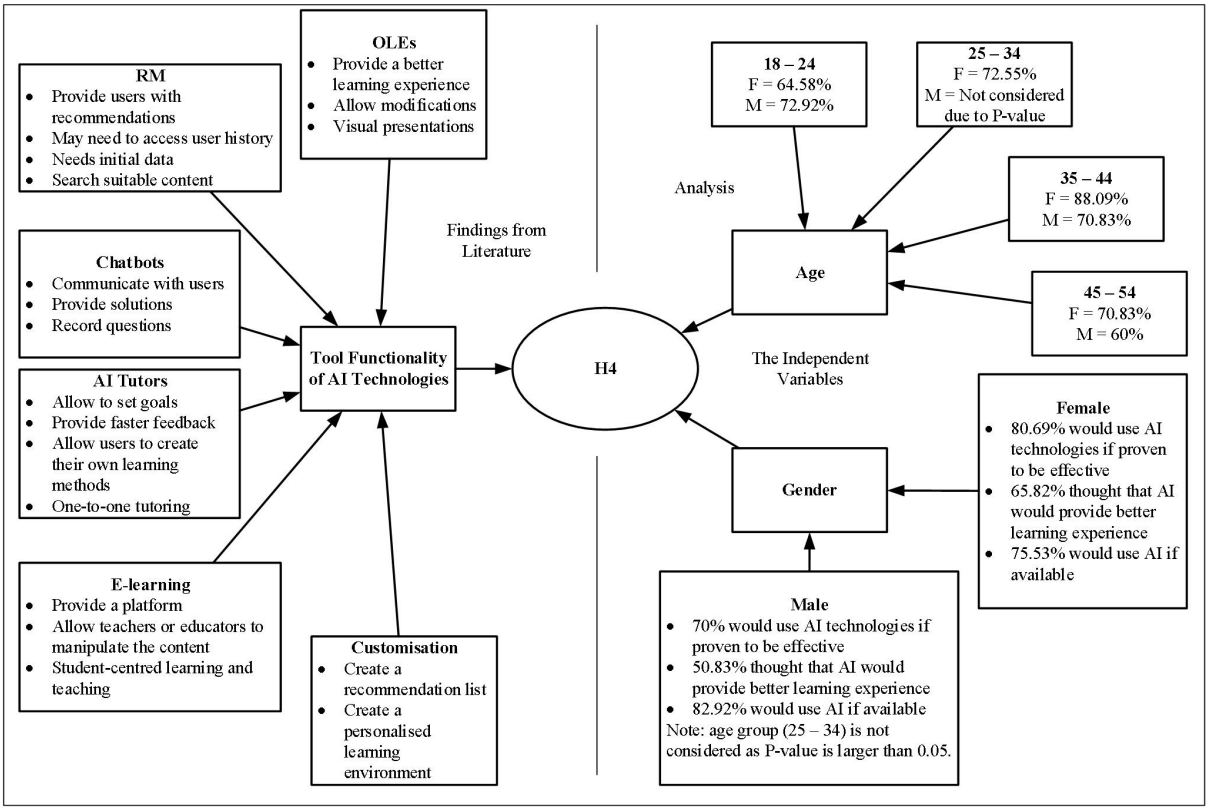

Figure 41. The Relationships between H4, AI Technologies and the Independent Variables

As shown in Figure 41, the tool functionalities of AI technologies are discussed. The extended discussion of the tool functionalities of AI technologies is presented in H1; however, the customisation and E-learning are not included in H1. Therefore, the customisation and E-learning are discussed below. The following section discusses the brief explanation of AI technologies.

According to Figure 41, there are six AI applications or technologies used in this research. The first is OLEs. OLEs are to create a better learning environment by having the ability to modify the visual presentations (see section 3.3.1.2). The second is RM (see section 3.3.1.1). RM or RS is to provide students with recommendations. One of the necessary steps to create a recommendation list is by accessing students' history of what they search in terms of educational content. To provide effective recommendations to students for the first time,

RM needs initial data in the form of specifying what they want and search for suitable content. Another AI technology is Chatbots (see section 3.3.1.4). One of the functionalities of Chatbots is to communicate with students. Another functionality is to provide solutions by communicating with students. There is also a function to record the commonly asked questions.

Another AI technology is AI tutors (see section 3.3.1). As mentioned in Figure 41, AI tutors can offer one-to-one tutoring by giving an opportunity for students to create their own learning methods. They can also provide faster feedback and also allow students to set their goals or objectives. E-learning is a platform that can allow teachers and tutors to manage the content that they want to put up (see section 3.3.2.2). They can also be used as student-centred learning and teaching platform. Customisation allows students to create a recommendation list by using RM and personalised learning environment that removes the possible duplications (see section 3.3.2.1).

The data used in this section are the average percentages of Tables 11, 12, 13, 14, 15, 17, and 18 of Q6, Q7, Q8, and Q10. Figure 41 shows that there are two independent variables. The first is gender. As presented in Figure 41, 80.69% of females' groups would use AI applications if they are proven to be effective in their performances. Only 70% of males' groups would use AI technologies to improve their performance. This finding maps with the finding from H1 as males usually underperform in education since, they would not intend to use AI to improve their performances.

65.82% of females agreed that AI would provide a better learning experience, while only 50.83% of males thought the same. Comparing to the above finding reveals that the percentages of who agree that AI would provide a better learning experience are significantly less than those who would use AI for better performances.

75.53% of females would use AI technologies. On the other hand, 82.92% of males (not including the males' age group (24 – 35)) would use AI technologies. Even though male participants (47) are significantly less than females (95), the males' groups' percentage is more than females' groups. This finding shows that males are willing to try new technology, which maps the finding from H1.

Another independent variable is the age groups. 64.58% of the females' age group (18 – 24) would use AI technologies, while 72.92% of males' age group (18 – 24) would use AI technologies. In this finding, young males are willing to try new technologies than young females, or young females do not realise that they are already using these technologies on a

daily basis. 72.55% of the females' age group (25 – 34) would use AI technologies. The males' age group (25 – 34) is not significant or considered as the P-value of this group is larger than 0.05, as discussed in section 5.8.5.2.5. The females' age groups (35 – 44) and (45 – 54) have higher percentages (88.09% and 70.83% respectively) compared to the males' age group (35 – 44) and (45 – 54) with 70.83% and 60%.

The older females' groups are willing to use new AI technologies more than the males' groups. This finding shows that age affects using or trying new technologies, which is the opposite of age, not having an effect on the acceptance of technology, as discussed in H1. The younger males are more willing to use AI technologies than females.

H5: AI is a tool that students do not need for their study.

H5 is to find out whether AI is just a tool and does not offer or have a huge impact on education or students. The task requirements of AI technologies are discussed in H5 along with the independent variables of age groups, and gender to understand the expectations of AI technologies. Figure 42 provides the relationships between H5, the task requirements of AI technologies, and the independent variables.

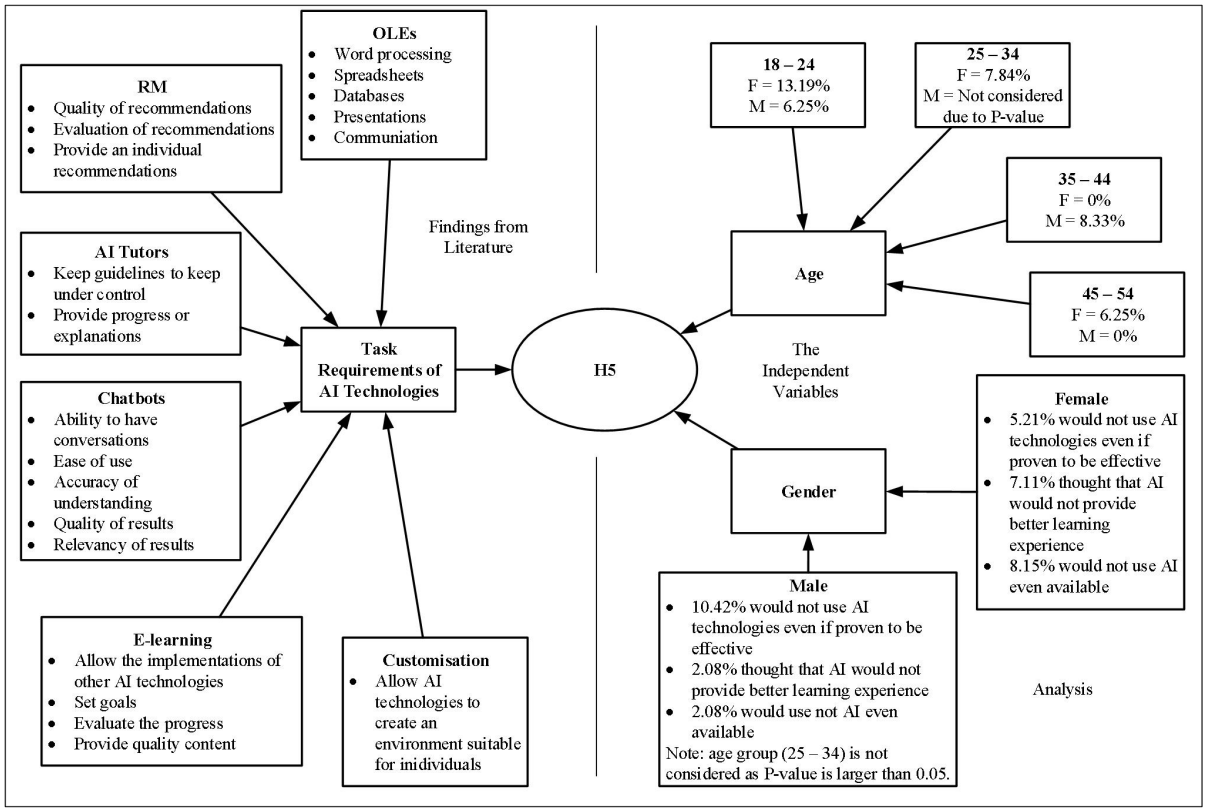

Figure 42. The Relationships between the H5, the Task Requirements, and the Independent Variables

As discussed above, Figure 42 presents the task requirements of AI technologies, which is discussed in H2 with the exception of customisation and E-learning. For that reason, customisation and E-learning are discussed below. A brief explanation of AI technologies is provided below, as well.

As discussed in H2, OLEs, RM, AI tutors, and Chatbots are four main AI technologies used in this research. According to Figure 42, the task requirements or expectations of OLEs are to have abilities such as word processing, creating spreadsheets, using databases to store the data, and creating presentations (see section 6.2.3.2). RM needs to have quality recommendations, evaluating recommendations, and providing individual-based recommendations (see section 6.2.3.2). The expectations of AI tutors are to provide students

with the options to create their own learning methods within the guidelines. Another expectation to provide progress or steps taken to solve or get to solutions. One of the main task requirements of Chatbots to have conversations with students using NLG (see section 3.4.1.). Other requirements are ease of use, the accuracy of understanding, quality, and relevancy of results, as mentioned in section 6.2.3.2.

E-learning can provide a platform to implement other AI technologies, allow to set goals from students, evaluate the progress, and provide quality content (see section 3.3.2.2). The expectation of customisation is to allow AI to create better and useful online environments that are catered to individuals' needs.

Findings from the analysis of gender present that 5.21% of the females' groups and 10.42% of the males' groups without the males' age group (24 – 35) would not use AI technologies even if they are proven to be effective in education. 7.11% of the females' groups and 2.08% of the males' groups thought that AI would not provide a better learning experience for students. 8.15% of the females' groups and 2.08% of the males' groups would not use AI technologies even if they have access to use them. Looking at the findings indicates that H5 can be concluded as not approved by the available data set as students would use AI technologies to improve their performances.

H6: AI will be a distraction for students.

H6 is to test whether AI applications can provide benefits for students by looking at the expectations or task requirements to consider the security concerns and issues around AI. The independent variables are to look at the percentages of respondents who would use AIED. Figure 43 provides the relationships between H6, the expectations of AI, and the independent variables. The data used for the analysis are the average percentages of Q11, Q12, and Q13. Table 59 and Table 60 provide the data needed for this hypothesis.

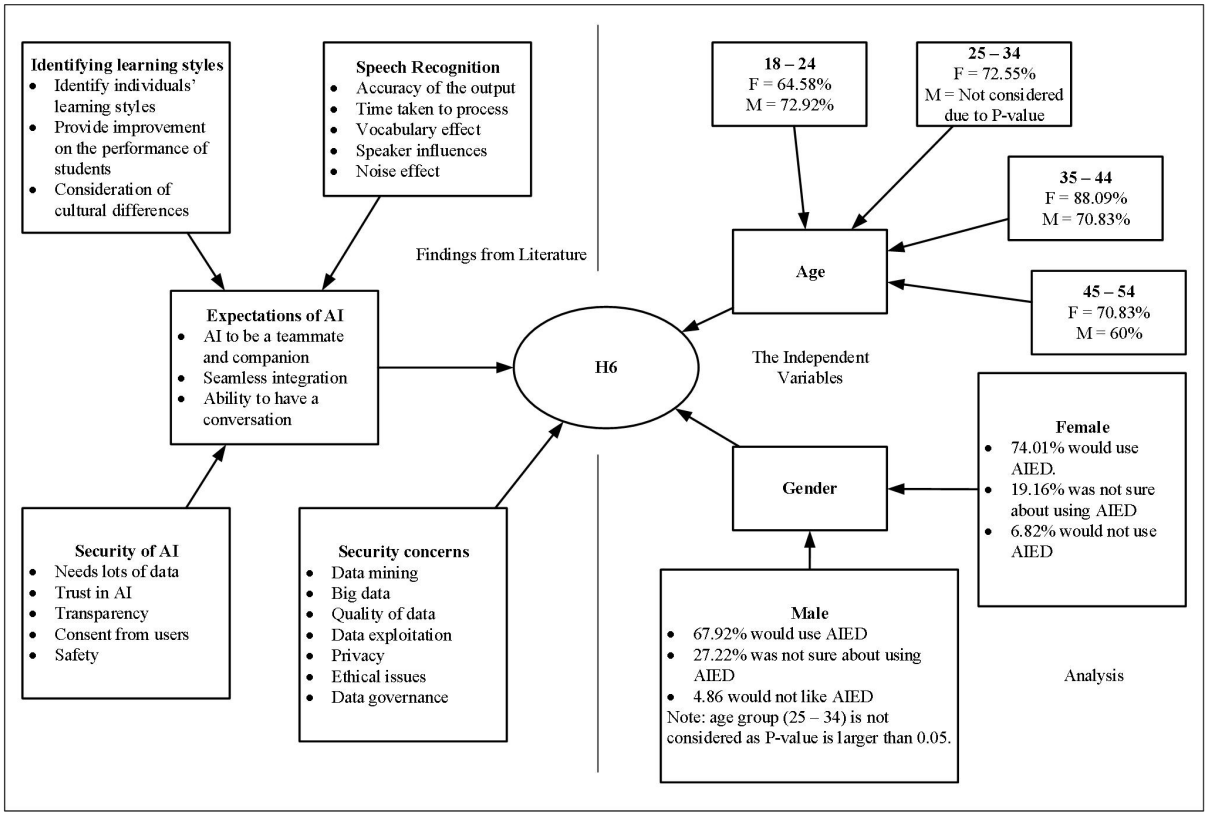

Figure 43. The Relationships between H6, the Expectations of AI, and the Independent Variables

The expectations of AI from students are to identify the learning styles of students, have conversations using speech recognition, have security features, and guarantee the safety of students. As discussed in section 6.2.3.3, speech recognition is to receive the inputs from students in the form of text or speech, decide whether further clarifications from a user is needed, and generate the output using NLG. During this process, there are many factors should be taken into considerations, such as the accuracy of the output, time taken to process, the effect of vocabulary, the influences from speaker meaning that the acceptance of the input should be flexible to understand many students, and the background noise effect (see Table 58).

Another expectation is to identify the type of students. The focus of this expectation relies on or determine the experience for students, meaning that if AI can successfully identify the type of students, the identification will have a positive effect on the recommendations and the visual presentations of LMSs. There are three main features to consider when identifying; the first is to identify the type of students, provide necessary features to improve the performance of students, and also consider the cultural differences of students.

The security of AI should also be the main focus. As mentioned in section 3.4.3, AI needs a lot of data to process. Therefore, the permission to use data of students should be a feature, and the consent from students should be gathered, or the permission should be granted by students to gain trust from students. Another feature that should be in AI is to have transparency, meaning that the use of data and the function of AI should always be available for students to see. These features will provide safety and gain the trust of students, in this case, students.

All of the features are to make sure that AI is not just a tool or an application that is available for students. AI should be much more than that. As described by Seeber et al. (2019), AI should be a teammate and a companion. Using AI as a teammate can create the best out of AI technologies and humans. To achieve this, the integration of AI should be seamless, meaning that AI should be a tool that can do what students want when needed (Seeber et al., 2019) (see section 3.4). Having a conversation with AI would create these features more seamless by using speech recognition (X. Wang & Yuan, 2016, p. 303). However, creating the AI technology capable of these features is not easy to accomplish as there are so many complications still to be solved (Spano & Boratto, 2019).

Security concerns are directly connected to H6, as this is not an expectation. The security features should be a function of AI. Big data is one of the up and coming technology; however, there are still security concerns around big data and security, as AI needs lots of data to process. Data mining is a good thing for education when considering students' behaviours as suggested by Mohamad and Tasir (2013). As big data is connected to AI, the quality of data should be considered as the raw data cannot be used (Vincent & Creteur, 2019). Another concern is data exploitation. There should be data governance to protect or layout the guidelines and rules when it comes to securing the data (Al-Ruithe & Benkhelifa, 2018). Privacy is still a big issue as not many research have been done on big data (Q. Liu et al., 2017, p. 206). Keskinbora (2019) mentioned that ethical considerations should be

implemented in AI. Langer et al. (2019) suggested that the rules and guidelines should be in place to protect students from being targeted for exploitations.

There are two independent variables, as shown in Figure 43. The findings from the analysis indicate that 74.01% of females and 67.92% of males would use AIED and expect these features to be implemented. 19.16% of females and 27.22% of males were not sure about AIED. 6.82% of females and 4.86% of males would not use AIED. These findings indicate that both genders would use AIED, as the percentages of those who would use AIED outweigh the percentages of those who would not use AIED.

Age groups also have an effect on AIED. 64.58% and 72.92% of the females' and males' age group (18 – 24) respectively would use AIED. 72.55% of the females' age group (25 – 34) thought that AI would not be a distraction even though there are still issues. The males' age group (25 – 34) was not included as the P-value of this group is larger than the standard P-value, as mentioned in Figure 35. 88.09% of the females' and 70.83% of the males' age group (35 – 44) would like to have AIED. 70.83% of the females' and 60% of the males' age groups (45 – 54) would also like to see the implementations of AIED, as discussed in H4. These findings show that age groups affect AIED as older females' groups think that AIED would be a good fit and will not be a distraction for students more than older males' groups. As discussed, gender also affects AIED as both females and males would use AIED.

6.3.1 Hypotheses and TTF Model

This section discusses the relationships between hypotheses, RQs, and the TTF model using the findings and results. Figure 6 of section 4.3.3 showed the placement of hypotheses and how they affect the TTF model. Figure 44 provides the relationship between hypotheses and the TTF model using the findings from Chapter 5 and Chapter 6. The hypotheses with the line across are hypotheses that are not approved by the data set.

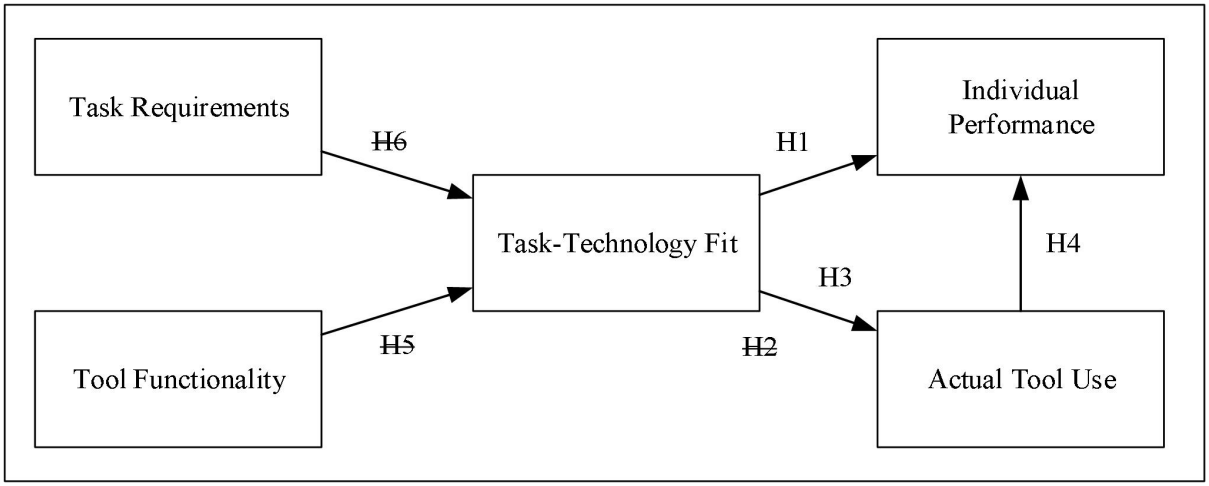

Figure 44. The Hypotheses and TTF Model (Adapted from: Dishaw and Strong (1999, p. 11))

H1: Students who use AI will have better performance.

H1 is to determine the fact that AI will have positive influences on students. As discussed in H1 of section 6.3, H1 is approved. Both females and males agree that AI will help them to improve their performance. However, females would use AI if it is proven to be effective. Males, on the other hand, would use AI technologies regardless. Males do not care whether AI would provide better performance for them or not. As discussed in section 4.3.3, H1 affects Individual Performance as females are more focused on using AI for their benefits. Gender also affects H1 as older females are more willing to use AIED, as discussed in H1.

H2: Students who do not use AI will have better performance.

H2 is to consider the fact that AI is not a necessity for students. The findings from H2 section 6.3 suggest that H2 can be concluded as not approved by the data. The females are willing to use AI technologies if AI has a positive impact and can help them improve their performances. Males, however, are not as willing as females to use AI technologies for their performances. Males would like to try new technologies more than females so that males underperform in education. Females are less likely to receive less technological education, as

discussed in section 6.2.1.1.2. This means that females have anxiety regarding using new technologies, in this case, AI. As discussed in section 4.3.3, H2 is to test the actual tool use of students. However, since the data do not approve H2, the actual tool use will not be affected by AI technologies.

H3: Students will not feel safe using AI online tracking systems.

H3 is to test the safety of students. As discussed in H3 of section 6.3, there are two findings. One of them is that the females' groups would not feel safe using online tracking systems. Another one is that the males feel safe using online tracking systems. As mentioned in the literature findings, females have anxiety towards using new technologies. These findings map with the fact that females are cautious about using AI. The females with age groups (18 - 24) and (45 – 54) have the highest N for answers as they are not sure about tracking systems. This finding shows that females of both spectra have security concerns more than the other groups. Males' groups, however, agree to use online tracking systems.

H3 sits on the actual tool use and task-technology fit join, as mentioned in section 4.3.3. Because there are not enough security measures implemented in AI, females do not feel safe using AI as a result.

H4: AI is a useful tool for students.

H4 is to make sure that AI is a useful tool that students can rely on and improve their overall performances. Looking at H4 of section 6.3 indicates that both females and males think that AI is a useful tool. Another finding is that older females are more willing to use AI more than their counterparts, as shown in H4 of section 6.3. This means that age affects actual tool use and individual performance. For these reasons, H4 is approved.

H5: AI is a tool that students do not need for their study.

H5 is to consider the fact that AI is a tool that students would not use as AI cannot offer any benefits, and is hard to use. H5 of section 6.3 shows that even though there are expectations of AI to do much more than what it can offer at this moment (see section 3.4), both females and males would use AI to improve their performances. All of the age groups of females and males have a small number of respondents who would not use AI. However, those respondents do not represent a significant amount. For these reasons, H5 can be concluded as not approved by the data.

H6: AI will be a distraction for students.

H6 is to examine the fact that AI will be unsafe online tools that offer no benefits for students. The discussion of H6 of section 6.3 indicates that females' and males' groups do not see AI as a distraction. However, there is a factor of age groups, and its effect as females' age groups (35 – 44) and (45 – 54) have higher percentages of those who think AI would not be a distraction than its counterparts. Although there are security concerns and limitations to what AI can do, respondents would use AI regardless. These findings show that H6 can be concluded as not approved by the data.

The next section discusses the relationship between hypotheses and RQs, as mentioned in section 2.6.

6.3.2 Hypotheses and RQs

As mentioned in section 2.6, the hypotheses are to answer RQs. Figure 45 shows the relationship between hypotheses and RQs. The reason why H2, H5, and H6 have a line across is to emphasise the fact that they are concluded as unapproved hypotheses in section 6.3.1.

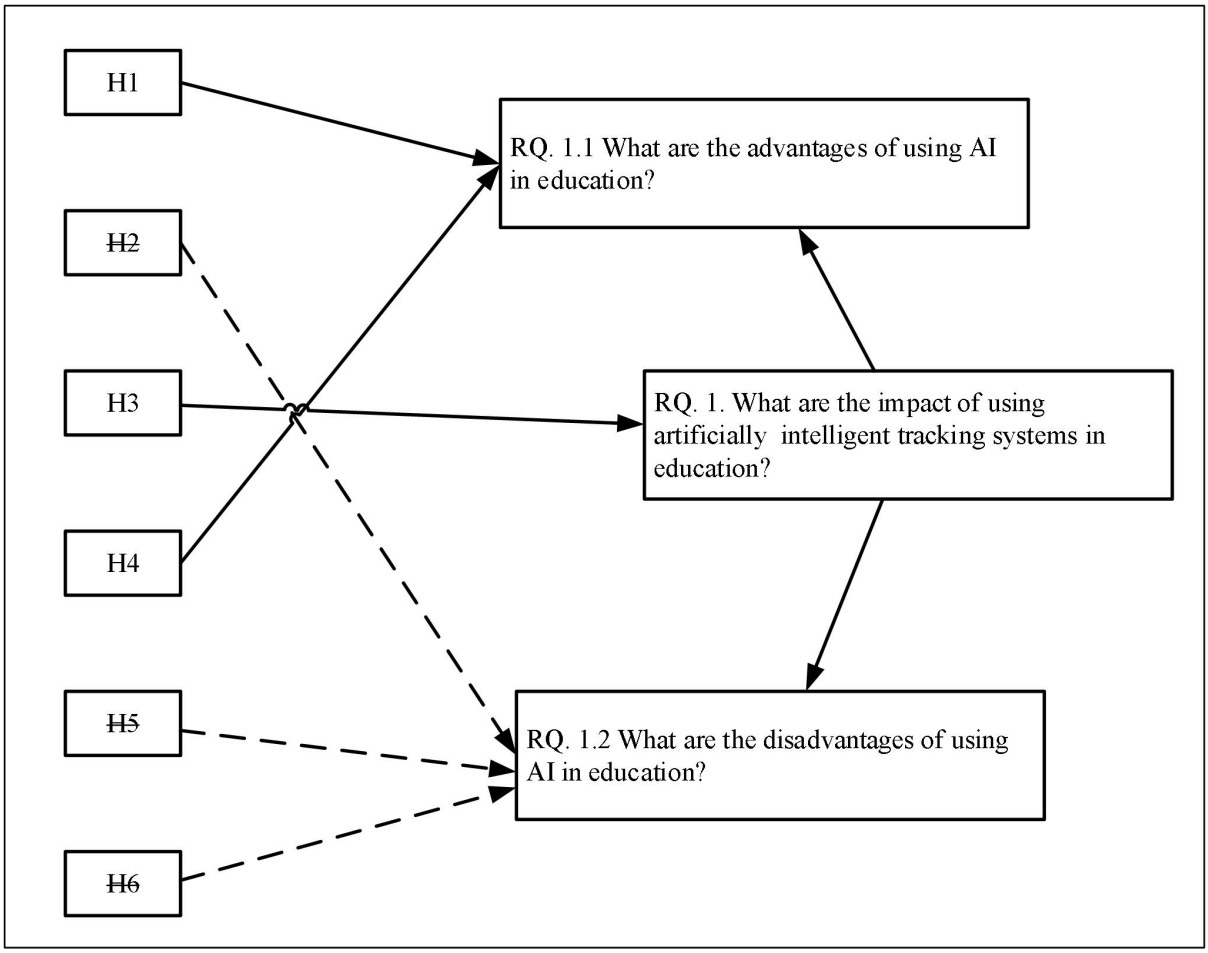

Figure 45. The Relationship between Hypotheses and RQs

RQ. 1 looks at the impact of using AI tracking systems in education. H3 provides the answer for RQ. 1. As mentioned in H3 of section 6.3.1, females would not feel safe using AI tracking systems. Males, on the other hand, would not mind having online tracking systems. The positives of using AI tracking systems are that the tracking systems can offer the performance tracking systems that can be used during test and measure an overall performance at the end of a particular subject or course. The progress tracking can track the progress or development of students by setting goals and objectives (see section 6.2.3.1, 3.3.1, and 3.3.1.2). However, females are concerned about security and safety. As there are not enough security measures to convince or motivate them to use AI tracking systems at this time, and the nature of creating such systems would require creating complex and

complicated applications that are not easy to build due to the limitations of software and hardware (see section 3.4), means that these factors have negative affect on AI tracking systems.

RQ. 1.1 is to find out the advantages of using AIED. H1 and H4 are to answer RQ. 1.1. H1 looks at the students, and H4 looks at AI technologies. However, both hypotheses are to find out the advantages of AIED. Looking at H1 indicates that individuals or respondents would like to use AI and think that AI will provide them with a better learning experience and improve their performances.

H4 looks at what AI technologies can provide and offer. The advantages of using AIED are that AI technologies can provide many benefits in terms of OLEs, RM, AI tutors, Chatbots, E-learning, customisation, and tracking systems. They all offer different benefits for students, as discussed in Chapter 3 and section 6.2.3.2. OLEs can provide students with better learning experience and environments, and also allow modifications by students while presenting visually pleasing environments.

The advantages of implementing RM are that RM can provide students with recommendations. To provide students with accurate recommendations, RM may need to have access to students' online activities. Providing recommendations to the first time may need to have the initial specifications or data from students. Overtime, RM will have more accurate content as to what students want (see section 6.2.3.2 and 3.3.1.1).

AI tutors can allow students to set their goals and objectives while studying. AI tutors can also provide feedback quicker than human tutors can as AI tutors can assess them in a shorter time. Students can also create their learning methods while receiving one-to-one tutoring, which is hard to achieve with human tutors.

The functions of Chatbots in education are to communicate with students, provide solutions, and record questions. The extended explanation of Chatbots can be found in section 6.2.3.2 and 3.3.1.4.

The capabilities of E-learning are to provide a platform that can allow the implementations of other AI technologies. Tutors and teachers can manage the content and create guidelines and rules for students to follow. One of the main intentions of using E-learning is to create student-centred learning and teaching (see section 6.2.3.2 and 3.3.2.2 for detailed explanations).

The customisation is to create a personalised learning and teaching environments for students (see section 3.3.2.1 and 6.2.3.2). The positive effect of online tracking systems is discussed above.

RQ. 1.2 is to look at the disadvantages of using AIED. As H2, H5, and H6 are unapproved, the negative effect of AI, according to respondents, are outweighed by the positives. However, the negative effect of AI still present, as mentioned in 6.2.3.3. The security is still a big factor to consider. As mentioned in H3 and H6 of section 6.3, AI needs a large amount of data. Not enough research have done on big data and security (Q. Liu et al., 2017, p. 206). Al-Ruithe and Benkhelifa (2018) suggested that data governance should be in place to take control of the data exploitations and misuse of data. There are also discussions around the transparency (see section 3.4.3.1). There should be a feature that asks permission of students by asking their consent to use data while providing the option to see the operations of AI in the background to create ethically acceptable applications (Keskinbora, 2019, p. 278). Having this feature will gain trust from students.

At this moment, identifying the learning styles of students is hard to achieve due to the fact that there are many factors to take into considerations (see section 3.4.2). The cultural differences and background play a big part in an individual's learning styles. (Altugan, 2015b) mentioned that cultural identity has a massive impact on education. Although there are questionnaires such as VARK to identify the type of students, AI cannot perform such tasks at this moment (see section 3.4.2). These factors prevent AI to have a positive impact on education and students. Bring AI to education cannot be considered as a success as there are still many factors to overcome.

6.4 Conclusion

This chapter discussed the results of Chapter 5 by testing the hypotheses and answering RQs using the data received from the survey. The age groups and gender were used to identify the relationship between the dependent variables, hypotheses, and RQs.

The outcome of this chapter points out that the females and males would like to have AIED. However, females were focusing on using AIED for their performance whilst males were willing to try new technologies. As males were not interested in using AIED to improve their performances, they tend to have less success in education compared to females. Females received less technological education, as mentioned in H2, they had anxiety towards trying new technologies. For that reason, females also had safety and privacy issues of AIED. Males, on the other hand, did not have any problems regarding AIED. Both females and males thought that AI would be a good addition to education. Older females would like to use AI more than younger females. Individual performance and the actual tool use were also affected by the age groups and gender, as shown in H1 and H4 of section 6.3.1. These outcomes presented that age and gender had an effect on new technologies.

There were many advantages and disadvantages of AI. According to the responses of participants, positives outweigh the negatives as the hypotheses that tested the negatives were all unapproved. There was also a concern about security by females, as discussed in H3. Males did not have any issues around security or safety regarding AI. Even though the hypotheses that tested the disadvantages were all unapproved, the issues were still there, as mentioned in section 6.3.2.

7. Conclusion

Pan (2016) described that AI with the new IT environment, including the Internet, mobile devices, and big data, could be the main driver towards the new development goals (p. 412). The effect of AIED and the management of AIED should be researched extensively to manage the dimension of students (Blanchard, Volfson, Hong, & Lajoie, 2009). Timms (2016) suggested that computer-based learning and teaching should not be the future as computers were intended to be used in business and personal use. For that reason, he promoted the idea of using robots with sensors that can monitor the actions of students. He also mentioned that AIED was the idea behind this suggestion as AI would drive this vision forward. Looking at these suggestions and ideas indicates that AI is the future of education.

This research was intended to explore the preceptive and opinions of students regarding AI to find out whether students, the ones who decide the fate of the new technology, were willing to use and would like to see the implementation of AIED.

This research began with the introduction to AIED and the objectives of the research. The objectives of this research were to investigate the relationship between AIED and the performance of students, the expectations of AIED, the creation of personalised learning environments, and the security and safety of students. A literature review (see Chapter 3) provided information about the previous studies conducted on the field of AIED.

An online survey was conducted to capture the opinions of respondents on AIED. 143 respondents participated in the survey. The data retrieved from the survey was used in Chapter 5 for analysation. For analysis, the P-value was conducted to find the significance between the variables, and the radar-charts were created to find out the pattern of answers, the figures and tables were created to simplify and understand the data. The discussion of data analysis was presented in Chapter 6. Chapter 6 discussed the relationship between the hypotheses, the variables, and RQs. The discussions presented that age groups and gender had an impact on individual performance and the actual tool use of the technology. From the findings, females had concerns about AI tracking systems while they are willing to try AI technologies to improve their performances. Older females were keen on using AI technologies than younger females. Males did not have any concerns around AI tracking systems; therefore, they expressed that they would like to use AI technologies. Another finding was that males usually underperformed in education compared to females. However, females tend to receive less education or lessons regarding technology. The acceptance of the technology was also affected by the age groups and gender as younger females were reluctant

to use new technologies, which reflected the finding of females being anxious to use new technology.

This research was conducted under time and cost limitations. The online survey was only active for four weeks. Therefore, this research did not reflect on the intended population requirement, as mentioned in section 5.5. This research did not also measure the performance of respondents in any way. The continued research is required to measure the performance of participants. The researcher hoped to contribute to the field of AIED with the perspectives of respondents and their opinions on using AIED. This research achieved in answering the objectives and RQs. This chapter discussed the results of Chapter 5 by testing the hypotheses and answering RQs using the data received from the survey. The age groups and gender were used to identify the relationship between the dependent variables, hypotheses, and RQs.

The outcome of this chapter points out that the females and males would like to have AIED. However, females were focusing on using AIED for their performance whilst males were willing to try new technologies. As males were not interested in using AIED to improve their performances, they tend to have less success in education compared to females as males are not interested in using AI technologies (see Chapter 3) to improve their performances. Females received less technological education, as mentioned in H2, they had anxiety towards trying new technologies (Huffman, Whetten, & Huffman, 2013). For that reason, females also had safety and privacy concerns around AIED (Sanders, 2005). Males, on the other hand, did not have problems regarding AIED. Both females and males thought that AI would be a good addition to education. Older females would like to use AI more than younger females. Individual performance and the actual tool use were also affected by the age groups and gender, as shown in H1 and H4 of section 6.3.1. These outcomes presented that age and gender have an effect on new technologies mentioned in Chapter 3.

There were many advantages and disadvantages of AI. According to the responses of participants, positives outweigh the negatives as the hypotheses that tested the negatives were all unapproved. There was also a concern about security by females, as discussed in H3. Males did not have any issues around security or safety regarding AI. Even though the hypotheses that tested the disadvantages were all unapproved, the issues were still there, as mentioned in section 6.3.2.

7.1 Further research

As mentioned above, this research did not capture the performance of respondents using AIED. There is a gap in finding the efficiency of using AIED in education based on age groups and gender. Research can be done on finding out the average time spent on one application and measuring the efficiency of individuals based on the experience, along with their age groups and gender.

As gender affects accepting and using technology, doing research to find out the contributing factors of females' anxiety towards new technology can provide insights as to why they feel this way.

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Appendix A

The Survey Questions

1) Please select your age group

- ☐ 18 - 24
- ☐ 25 - 34
- ☐ 35 - 44
- ☐ 45 - 54
- ☐ 55 - 64
- ☐ 65+

2) Please select your gender

- ☐ Male
- ☐ Female

3) Please state your role/position

- ☐ Teacher
- ☐ Student
- ☐ Studied within 5 years
- ☐ Studied over 5 years ago
- ☐ Others

4) What platform would you use for your study?

- ☐ Mobile Devices (i.e. smart phones)
- ☐ Desktops
- ☐ Tablets
- ☐ Laptops
- ☐ Others

5) Do you think using Artificial Intelligent performance tracking systems will improve the performance of students?

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

6) Do you think having an online learning environment where users can modify to their needs will improve the performance of students?

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

7) Do you think you would use a Recommendation Module, which will provide you with the educational content that suit your learning style depending on your preferences? i.e. If you are a reader, reading materials will be provided. If you are a visual learner, video content will be provided. If you are a listener, audio content will be provided.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

8) Do you think you would use Artificially Intelligent tutors that can give feedback to you instantly, for example, when assessments or practical works are complete, an AI tutor can give feedback within a short time period than human tutors can?

☐ ☐ ☐ ☐ ☐

Strongly Agree Agree Neutral Disagree Strongly Disagree

9) Do you think you would feel safe if an Artificial Intelligent tracking system is in your online environment?

☐ ☐ ☐ ☐ ☐

Strongly Agree Agree Neutral Disagree Strongly Disagree

10) Do you think you would use Chatbots, which have an ability to react to your questions by answering and asking specific questions using Natural Language Generations (NLG)? For example, if they can not evaluate or understand your question, they will ask another question to confirm your question.

☐ ☐ ☐ ☐ ☐

Strongly Agree Agree Neutral Disagree Strongly Disagree

11) Do you think you would use Artificially Intelligence if AI is proven to be effective in your study or learning process?

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

12) With above questions in mind, would AI technologies or applications provide better learning experience for students?

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

13) Would you use AI technologies if they were available?

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Appendix B

The Ethics Form

Wintec WAIKATO INSTITUTE OF TECHNOLOGY Te Kuratini o Waikato	**Research and Postgraduate Office (RPGO) Human Ethics in Research Group (HERG)**

LOW RISK HUMAN ETHICS IN RESEARCH APPLICATION FORM

Please refer to the Ethics Guidelines prior to completing this application.

The RPGO is located at the City Campus, D-Block (Offices D2.22 – D2.24), email research@wintec.ac.nz or phone Megan Allardice on Ext. 3582 for more information.

Please see the last page of this document for detailed instructions for completing this form.

1.0 PROJECT TITLE	
	What are the impacts of using artificially intelligent (AI) tracking systems in education?

2.0 RESEARCHER(S)		
2.1	Primary researcher's name	Thar Htin Shar
2.2	School//Centre/Unit	Waikato Institute of Technology – Centre for Business and Information Technology
2.3	Contact Details (Telephone and E-mail)	02102294844 tharhtinshar@gmail.com
2.4	Is this application a:	☒ Student Application ☐ Staff Application
2.5	If this is a student application, please provide the Module code here	Info 901
2.6	Is this project a staff application that utilises work partially or wholly undertaken by students who are not participants (e.g. data collection undertaken by a researcher's class)?	No

2.7	If so, please clearly describe what the role of these students is to be in this research, what the work will be used for explicitly (including any issues regarding authorship of research outputs such as journal articles), and what steps have been taken to ensure students are aware of this.	Not Applicable
2.8	Name of other Researcher(s) and positions. (If this is a student application please provide the name(s) of the project supervisor(s) and indicate that they are supervisors here.)	Kay Fielden
2.9	Contact Details of other researchers and/or supervisors (Telephone and E-mail)	
2.10	Is this application:	☒ A new application ☐ A subsequent approval request following a significant change to an already approved application

3.0 PROJECT TIMELINE	
	Projected start date for **data collection** *(once this ethics application is approved. Please note, projects can only begin once applications have been approved, regardless of the level of risk)*: 20 March 2019 Projected end date: End of Semester

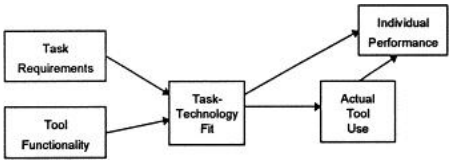
4.0 PROJECT SUMMARY (please include your research purpose and objectives, methodology will be dealt with in Section 6)

The purpose of this research is to investigate the use of e-learning in personalised environment and tracking systems to evaluate and analyse learners' performance and preferred styles of learning using artificial intelligence (AI). The objectives are to find out how e-learning can provide a platform for further advancement in technology and what e-learning has to offer regarding recommendations and suggestions. Tracking systems will keep track of the progress of students on how they are performing and what they do in study time in order to provide the best possible learning environment.

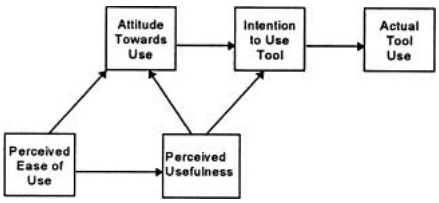
5.0 PROJECT METHODOLOGY (including methods for data collection)

Data will be collected using online survey website (surveymonkey.com). A series of questions that are related to this research will be in the survey. The data collected is used to investigate the impacts of using AI in education.

Task-Technology Fit model will be used as a methodology to find out the usefulness of AI in education.



Technology Acceptance Model will be used as a starting point to look at the actual benefits of using AI in education.



6.0 CONSIDERATON OF ETHICAL ISSUES AND PROCESSES

Please describe below the process that you have undergone in order to discuss and analyse the ethical issues present in this project. (For example, who have you consulted in regards to ethical issues or in completing the screening questionnaire and this Low Risk application)

1.0 Risk of harm

There will be no risk of harm

2.0 Informed and Voluntary Consent

The participants involve in this research are older than 18 and they will not be in dependent situation. The participants are able to give written consent. There are no participants who are otherwise unable to give informed consent. The participants are not vulnerable in any way. No biological sample or information are used in this research.

3.0 Privacy and Confidentiality

No sensitive will be collected. The research does not involve any particular organisation services or practices.

4.0 Deception

There are not deception.

5.0 Conflict of Interest
There are not conflict of interest.

6.0 Compensation to Participants

There is no compensation to participants.

7.0 Procedural

No outside ethical approval is required. Wintec Institutional Consent Form is not required.

8.0 Treaty of Waitangi and Maori Participation

Maori are not the primary focus of the research.

9.0 Other Cultural Consideration

The research does not target a particular ethic group. The research will not raise any cultural issues.

10.0 Health and Disability Research

This research does not include any disability issues. The participants in this research are not recruited to participate as caregivers or relatives of consumers of health and disability support services. The participants are not volunteers in clinical trial. The research does not involve any human tissues. No participants health information will be collected in this research.

Researcher(s) signature(s) (the <u>name and signature</u> of all researcher(s) are to be included):		
Name	**Signature**	**Date**
Thar Htin Shar		

Primary Supervisor's signature (if this is a student application):		
Name	**Signature**	**Date**
Kay Fielden		

Research Leader's signature:		
Name	**Signature**	**Date**

HERG Chairperson or delegated representative's signature (RPGO use only):		
Name	**Signature**	**Date**

COMPLETING THIS FORM

Please note: A low risk research project is one in which the nature of the potential/actual risk of harm to participants or the researcher is minimal and no more than is normally encountered in daily life. If, as a staff member, you are new to research or are in any doubt as to which application to submit, please consult with your Research Leader. If you are a student, your supervisor will be able to give you advice. If you are still in any doubt, don't hesitate to consult the RPGO.

Specific Instructions

- All questions are to be answered. Note the questions within require a mix of descriptions, yes/no answers and cross the box (**Double-click on check boxes with your mouse and select 'Checked' from the options under 'Default Value'**).
- Research Leaders need to review the information in this form and sign it off prior to application being made to the RPGO.
- Please forward one signed original copy to the RPGO, together with an electronic version to research@wintec.ac.nz.
- Low Risk Human Ethics in Research Applications also need to be accompanied by a copy of the Information Sheet, Consent Form, and any Questionnaires or Interview Schedules for consideration. If Questionnaires/ Schedules are not yet confirmed, please supply the latest draft.
- No questions are to be deleted, even those that you feel you are not required to answer.
- No part of the research requiring ethical approval should commence prior to approval being confirmed.
- Applicants will receive an official confirmation of submission via email from the RPGO once all conditions of this form have been completed.
- If you want to apply for an extension on a previously approved project, please contact the RPGO, as you will probably not need to submit a separate application.
- Applicants will be advised of the outcome of their application to the Human Ethics in Research Committee **no later than ten working days** after the completed and confirmed submission of this application.

HUMAN ETHICS IN RESEARCH LOW RISK APPLICATION FORM - CHECK LIST	
Research project title:	**What are the impacts of using artificially intelligent (AI) tracking systems in education?**
Name of primary researcher:	**Thar Htin Shar**

Attached please find (as applicable) in the order listed below	
Completed HERG Low Risk Application Form	☒ Yes ☐ No

Consent Form for participants	☒ Yes ☐ No
Information Sheet for participants	☒ Yes ☐ No
Copy of Focus Group Questions, Interview Schedule, or similar	☒ Yes ☐ No

Appendix C

The Ethics Approval Letter

Waikato Institute of Technology
Research and Postgraduate Office
D Block, Tristram Street / Private Bag 3036
Hamilton 3240
e-mail research@wintec.ac.nz
Telephone 07 834 8800 Extn 3582

6 March 2019

Centre for Information Technology
Thar Shar

Dear Thar,

LOW-RISK HUMAN ETHICS RESEARCH APPLICATION

Title: Artificial intelligence in education

Thank you for your low-risk application which was considered by the Chairperson of the Human Ethics in Research Group on 6 March 2019. I am pleased to inform you that low risk ethics approval has been granted.

Ethical approval is granted to 31 December 2019 or until the project has been completed, whichever comes first.

The Chairperson and the Human Ethics Research Group wish you every success with this project.

Kind regards

Megan Allardice
pp Elizabeth Bang
Chairperson
Wintec Human Ethics in Research Group.

C.c. Kay Fielden, Supervisor.

Glossary

Term	Definition
Artificial Intelligence (AI)	A term used for simulated machines that are programmed or trained to think like humans.
AIED (Artificial Intelligence in Education)	AI applications or technologies that are used in education.
Customisation	A term used for applications or technology that allow students to make changes visually and technically.
Data governance	A term used for managing the availability, usability, integrity, and security of data.
Data exploitation	Illegal collection or usage of data or misuse of data
E-learning	A term used for studying using electronic devices
Hypotheses	A statement to predict, measure, and compare the research's findings with literature.
Individualisation	A term used for allowing individuals to have their own learning environment in education.
Individual Tracking	A term used for tracking the process of individuals performance in education.
Personalisation	A term used for allowing individuals to have ability to choose the study content or materials they want.
Progress Tracking	A term used for tracking the progress of individuals study process.
Recommendation Module (RM) or Recommendation System (RS)	A term used for providing individuals with recommended content or list based on their previous selections of content and materials of study.
Research Methodology	A term used for the structure of a research and how a research is going to be carried out
Task-technology Fit Model	A theoretical framework used for measuring an individual's performance and actual tool use of technology by looking

at task requirements and tool functionality